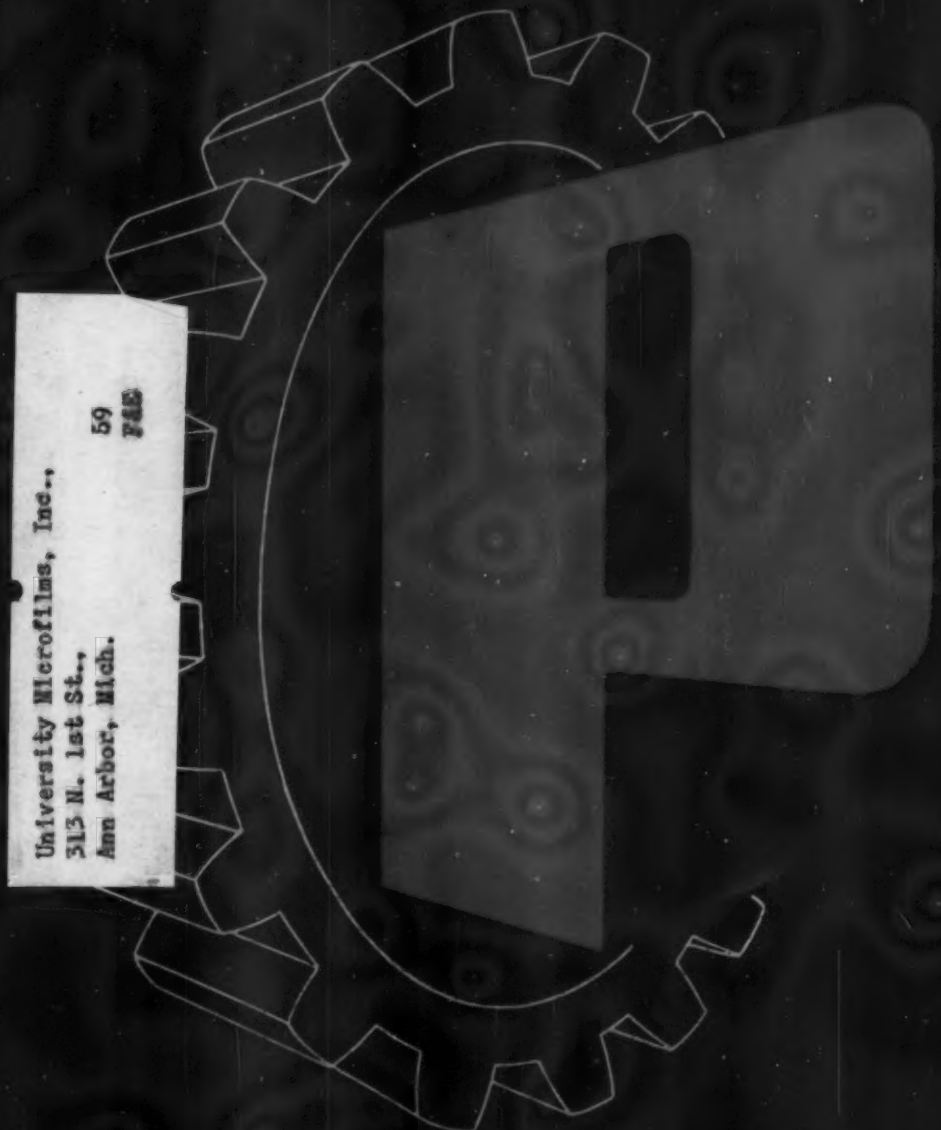
PLASTICS TECHNOLOGY

MAY 1961

THE MAGAZINE OF APPLIED ENGINEERING



University Microfilms, Inc.,
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Ann Arbor, Mich.
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FAE

9TH NATIONAL PLASTICS EXPOSITION

Among the important factors in Shell Chemical's decision to make polystyrene were its extensive background in polymers and its raw material position. Two other Shell thermoplastics followed quickly—polypropylene and polyethylene.

BULLETIN:

On May 3, 1960, a remarkable thermoplastics decision was made by Shell Chemical

Read about this Shell decision. And how you can start benefiting today from a major new source of polystyrene, polypropylene and polyethylene that resulted from it.

ON MAY 3, 1960, Shell Chemical, a company long basic in styrene monomer and SBR rubber, decided to combine the two in full commercial production of Shell high impact polystyrene. Why was this remarkable?

A revealing fact on polystyrene

The condition of the polystyrene market was not attractive. There was oversupply from some of America's finest companies. The field was mature and Shell was starting late.

One revealing fact offset this situation. *Shell, with its excellent background in polymer chemistry—as exemplified by Shell Isoprene Rubber, the industry's first commercially produced synthetic/natural rubber—could make positive contributions to the thermoplastics field in the form of new products.* But Shell would be severely handicapped without a thorough understanding of how the thermoplastics market works and what it wants.

Result? Shell's decision to go full speed ahead with high quality general purpose, medium and high impact Shell polystyrenes, plus a rapidly expanding technical sales force.

80 million pounds of polypropylene

Two other thermoplastic developments followed quickly.

One, Shell's announcement in October, 1960, for an 80 million pounds a year polypropylene plant with customer service and research facilities to be built near Woodbury, N. J. Two, an arrangement by which Shell will resell limited quantities of polypropylene until this plant comes on stream.

Custom-made polyethylene

And this, in turn, led to a third important thermoplastic.

In order to round out a complete line of thermoplastics, Shell Chemical, in January, 1961, made arrangements to supply the industry with the highest quality custom-made polyethylenes.

How to start benefiting

Thus, within 8 months, Shell became an important factor in three plastics: Shell polystyrene, Shell polypropylene and Shell polyethylene.

The next 8 months should be even more important. Shell will be going full speed ahead searching for new polymers you want.

Now is the time to let Shell's technical representative know your needs. Tell him about them on his next visit or write Shell Chemical directly at:

42-76 Main St., Flushing 55, N.Y. FLushing 3-4200; 20575 Center Ridge Rd., Cleveland 16, O. EDison 3-1400; 6054 West Touhy Ave., Chicago 48, Ill. SPring 4-6711; or 10642 Downey Ave., Downey, Calif. SPruce 3-0601.

A Bulletin from

Shell Chemical Company

Plastics and Resins Division

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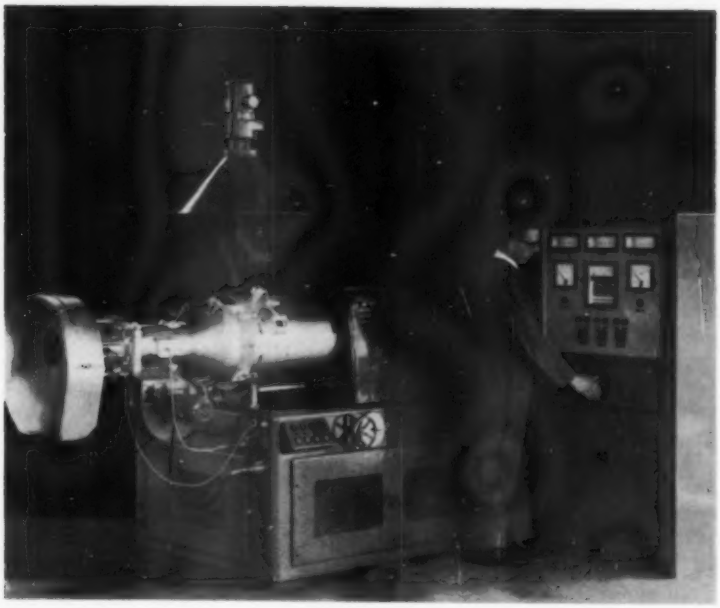
PLASTIFICATOR PK 100/V

the new continuous compounder for plasticized PVC



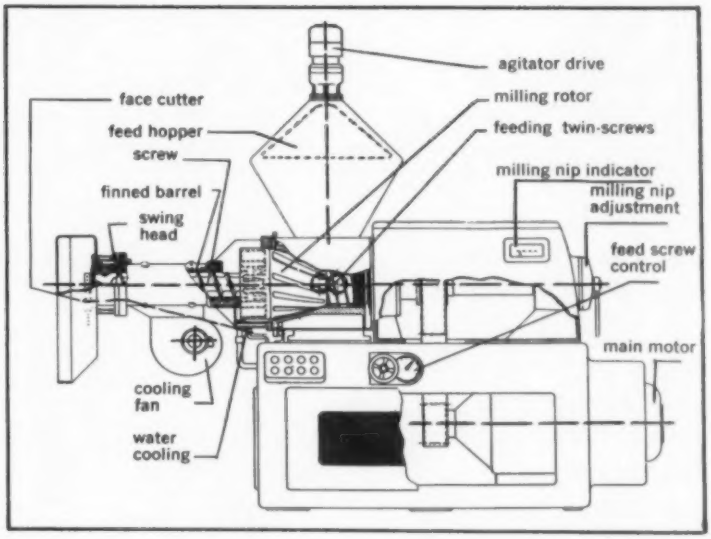
mills the preblend to greater homogeneity by passing each particle through the circumferential milling nips with the same frequency and for the same time

generates exactly the required heat by shearing stresses within the PVC controlled by stepless adjustment of the milling nips to the desired stock temperature during operation.

reduces the heat history by a shorter residence time for all particles, thus often saving half of the stabilizer

removes moisture from the preblend

densifies and extrudes the PVC at lowest temperatures into pellets of regular shape obtained by face-cutting, strand pull-off or strip dicing, at output rates of 400 to 600 lbs/hr



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PLASTICS
THE MAGAZINE OF APPLIED ENGINEERING
TECHNOLOGY

May 1961, Vol. 7, No. 5

feature stories:

A micro-flow melt indexer—how to build it ..... p. 45
by R. E. Wiley
Melt index is the most commonly used standard for measuring thermoplastic flow. The standard indexer is both unwieldy and requires large amounts of material for testing. Plans are given for building an accurate, miniature unit; results are correlated.

Management problems in injection molding ..... p. 76
by A. R. Morse
Injection molding is different from other businesses, and standard procedures for determining costs, etc., simply do not apply. The article points out how shop practices differ in an injection division within a larger firm. Management tips and pitfalls are emphasized.

Single-screw injection molding ..... p. 53
by J. G. Fuller and H. Frimberger
The various principles of the injection machines are described in some detail, and the single-screw type is compared to the ram-cylinder unit. The article does emphasize the advantages of the former; however, it points out the areas where definite advantages or disadvantages lie. More importantly, it describes fully the mechanics of single-screw injection which is a topic of much current interest.

Formulating reinforced plastic premixes ..... p. 84
The variables in batch mixing are reinforcement, resin formulation, timing, cycle, and the unit used. Area of compromise is surface finish vs strength. Baker Perkins machinery was used as the basis for the article.

exploring fabrication techniques:

Foamed vinyl ..... p. 86
by L. J. Zukor
High costs prevented vinyl foam from "really getting off the ground;" however, new processing techniques, improved machinery, and better blowing agents bring it into the picture once again.

special section on exposition and conference:

9th NPE—Symbol of the future ..... p. 63

How to get the most out of the 9th national plastics exposition ..... p. 64
by L. J. Zukor
Suggestions for organizing one's time and energies. The article points out the value of our classified lists, floor plans of the coliseum, etc.

Alphabetical list of exhibitors ..... p. 66

Classified list of exhibitors ..... p. 69

Coliseum floor plans ..... p. 72-73-74

1961 SPI Conference program ..... p. 75

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NBP BPA

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630 Third Ave.
New York 17, N.Y.

there are always good reasons for designing it in AVISUN polypropylene

This polypropylene trap catches all foreign items and prevents gurgling in RCA Whirlpool's 1960 Automatic Washer. AviSun Polypropylene's excellent molding characteristics make possible the intricate, cost-saving design of the molded-in baffle and air vent. Custom-molded by Precision Plastics, Columbia City, Ind.

See your souvenir AviSun polypropylene pill box with self-hinge injection molded on the new high speed Rotojet . . .

BOOTHS 1151-1248

National Plastics Exposition

New York Coliseum June 5-9

in RCA Whirlpool washers *it's heat and chemical resistance*

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3. **Toughness**
4. **Economy**

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Letters to the Editors

Words for action

Sirs:

Your editorial on the "Hot Dog Salesman" was timely in re: to business activity pausing in its long term rise and in some quarters the gloomy talk of a "depression" or a similarly ominous eventuality rearing its ugly head.

Although it is hard to believe that talk alone can turn a basically healthy economic picture into a pronounced downturn, this story certainly provides a thought provoking moral and it came at a most appropriate time.

Recently learned that the original author of this story was Mr. R. C. Trundle, president of a management consulting firm, to whom we should feel most indebted for this wise and timeless little essay.

Richard E. Kolekamp
Lear, Inc.
Instrument Division
Grand Rapids 2, Mich.

(A belated byline for R. C. Trundle, and commendation for a pithy essay.—Editor.)

Sirs:

No, gentlemen, we don't know who originated the editorial in your March issue, but we think featuring it was a marvelous idea.

Recession? What recession? From our desk, all we can see is more business than we are equipped to handle. Not that we're turning anyone away, but it's frustrating to realize that a lot of new work is there for the asking—without having the time to ask.

We've all castigated "Engine Charlie" for his remark about the scratching dog. In retrospect, however, he was absolutely right. If you want work, or accounts, or new business, you've got to get out and scratch for it. It's there!

Lucien Greif
Greif-Associates, Inc.
New York 1, N.Y.

•

Sirs:

I want to tell you again how much I appreciate [PT's tabulation of compression and transfer molding machines] this service to the industry. I feel it benefits the machinery manufacturers as well as the users and prospective buyers of such units. I hope you will continue the program.

As to . . . the reporting in the 1961 version, I would like to suggest that you use the term "die space" instead of "molding or working area, psi.," and "platens or molds: maximum size, inches." Additionally, I am a little confused about your request for "ram or plunger: stroke, inches, and opening." It would be more clear if you stated transfer ram stroke" and "platen stroke."

No mention is made in your report as to whether the press is for a self-contained installation, or whether the press frame must be tied into an accumulator system. You might have a simple category, "hydraulic pressure, self-contained or accumulator."

Additionally, you do not request information on whether or not the machine includes provision for mechanical or hydraulic knock-out, or provision for attaching mold to platens (tee slots, drilled and tapped holes, etc.). These latter two features are of importance to persons buying compression and transfer equipment, but do not apply generally where the press is to be used for laminating purposes.

You probably have dozens of similar suggestions. We certainly are happy to cooperate in any way to keep this program as successful as it is.

John L. Hull, Vice President
Hull Corp.
Hatboro, Pa.

•

Sirs:

In the January 1961 issue of PLASTICS TECHNOLOGY, pages 29-32, there appears an article entitled "Relationship of Surface Defects to Surface Failures in Reinforced Plastics" by W. J. Diamond.

Twelve copies of this article are desired to assist us in a research program we have recently launched. Efforts made to expedite the procurement of these articles will be greatly appreciated.

J. Madsen, Assistant Chief
Structural Plastics Section
Materials Research & Process Engineering
Douglas Aircraft Co., Inc.
Santa Monica, Calif.

We invite letters from our readers for publication in these columns. Such letters The only requirement is that all letters may be of comment or criticism, requests for information, or of general interest. must be fully identified as to name of sender, company affiliation and address.

A letter will not be printed if publication is not desired by the sender, and the identity of the writer will be withheld, if desired.

—The Editor

On Schedule

One article definitely on schedule describes the "Ultra-Violet Curing of Unsaturated Polyester Resin Systems." Compiled by J. Kaminetsky, N. Fried, and R. R. Winans of the Brooklyn Naval Material Laboratory, it tells how laminates are fabricated by artificial ultra-violet radiation at 0 and 25° C., and in direct sunlight. Three sensitizers are used. Laminates compared favorably with those cured by conventional peroxides, and both long pot-life and short gel periods were obtained. This is especially important in laying up complex structures.

•

Another article is on vinyl stabilization by Charles Fuchsman of Ferro Corp. Its thesis is that changes in physical properties are responsible for interest in chemical changes, and how you can go about changing the former by controlling the latter.

•

Ciba is supplying an article on some of the newer epoxy systems, and Metalmold Forming will tell how molds (spray metal on epoxy) were made for thermoforming chocolate-casting trays. Over 6,000 tiny holes are required for pulling a vacuum for these very large trays.

•

In the coming months, "Exploring Fabrication, Techniques" will cover such subjects as Automatic Injection Molding, Polysulfide Materials, and Thickness Gages. Other staff material will include an article on Conveying Techniques, and will be an overall survey of plastics materials handling.

•

Other topics scheduled for running in the near future, but on which the material is not yet definitely set includes methods for foaming urethane in place, calendering of vinyls—special problems, and injection blow molding.

•

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WIZARDRY WITH **PHENOLIC MOLDING COMPOUNDS**
FOR HANDLING "WORKING STEAM"

This is the new *Steam-Dry* Iron whose "working fingers of steam" issue from 21 vents to smooth away wrinkles fast. It's made by National Presto Industries, Inc., Eau Claire, Wis. Although its ironing surface is extra large and its tank holds up to 30% more water, the Presto iron is surprisingly light in weight. A woman can maneuver it with aplomb—and with perfect safety.

Pardon us if we take a bow at this point—for Plenco phenolics. For the iron's stay-cool handle, control housings, and body are all incorporated into a handsome, one-piece assembly molded with Plenco 466. This special-purpose molding compound meets every Presto test for heat resistance, insulating properties, dimensional stability, durability, and is made to weather steam-ironing conditions of 100% humidity.

Plenco 466 is one of many excellent Plenco phenolic molding compounds available . . . general- as well as special-purpose, ready-made as well as custom-formulated. Our technical counsel and practical experience is also available, always. You've only to call.

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"PLASTICS PEOPLE" DON'T BLUSH...

when they're processed with Barber-Colman Controls

Even minor off-color "blushing" is eliminated when injection molders and extruders are Barber-Colman equipped. Barber-Colman Controls offer true color and accurate form through precise temperature control. And now, you can indicate temperature or pressure measurements on only one instrument with Barber-Colman's new 400 Series Capacitrols. Simply flip a selector switch to indicate the temperature or pressure. Also, you can record any combination of temperature and pressure up to 24 points with the new Series 8000 Recorders. Barber-Colman's wide ranging automatic process controls are the first choice in the Plastics Industry. Contact your nearest Barber-Colman, Wheelco Industrial Instruments Division office or write direct for complete information.

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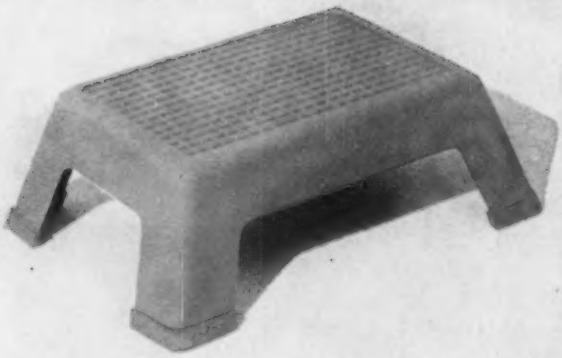

INJECTION MOLDED—This hospital footstool is typical of the products and parts made of MARLEX for hardware, auto, appliance, furniture, housewares, toy, and other industries. (Footstool, Consolidated Molded Products, Scranton, Pa.)

THERMOFORMED—Many items are economically formed of MARLEX sheet: tote boxes, trays, automotive and industrial components, food packages . . . even light, sturdy boats. (7' SPORTYAK®, Woodall Industries, Inc., Detroit 34, Mich.)

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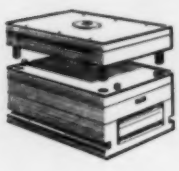

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READY

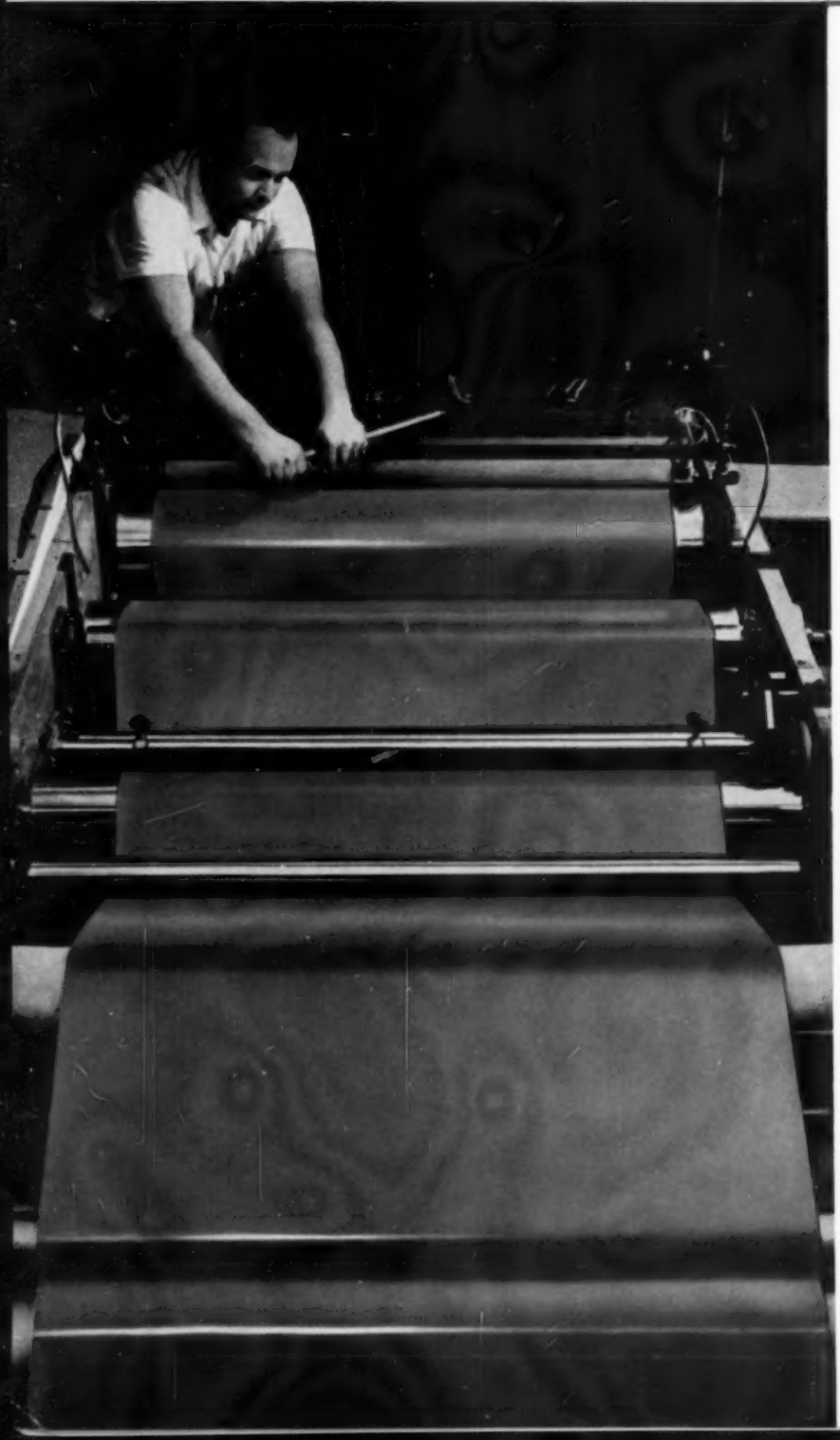
...to help you plan new products
...to help you improve existing products
...to help you cut manufacturing costs

Since February, 1961, Tenite Polypropylene has been in commercial production at Eastman's new plant in Longview, Texas. This is the newest member of the Eastman family of thermoplastics, all bearing the trade name "Tenite."

In Tenite Polypropylene, industry has a versatile new plastic that will replace conventional materials in many traditional applications . . . a plastic that will improve the performance of hundreds of existing products . . . a plastic that could markedly reduce material, fabricating and assembly costs.

And it's a material that's now available in carload quantities.

Tenite Polypropylene offers a broad range of useful properties



High Strength — Tenite Polypropylene has good tensile and impact strength, plus rigidity and surface hardness.

Light Weight — Tenite Polypropylene is the lightest of all solid plastics. This plastic produces more molded or extruded product per pound than most other plastics.

Heat Resistance — The high melting point of Tenite Polypropylene permits objects made from this plastic to be sterilized without suffering distortion. This feature makes it well-suited for hospital and laboratory ware.

Chemical Resistance — Tenite Polypropylene resists the attack of acids and alkalies and a broad range of other chemicals.

Fatigue Resistance — Because it can take innumerable flexings, Tenite Polypropylene can be designed as one-piece moldings with integral hinges.

Resistance to Moisture Vapor Transmission — Tenite Polypropylene is an effective barrier to moisture vapor transmission. In film for packaging, this feature is a vital factor in prolonging the freshness of many foods.

Red polypropylene sheet rolls off an extruding machine in Eastman's plastics development laboratory. For two full years before launching polypropylene production on a full-scale commercial basis, Eastman engaged in exhaustive research and study of the characteristics and properties of polypropylene, thoroughly pretesting the material in actual molding and extrusion operations and developing a number of formulations for use in plastics fabrication.

Tenite Polypropylene can be used in all these ways

Dielectric Strength – Tenite Polypropylene has excellent dielectric properties and retains these properties even under adverse moisture and temperature conditions.

Abrasion Resistance – Tenite Polypropylene has excellent abrasion resistance. Its surface hardness suggests its use as gears or bearings. Conveniently, it also has a low coefficient of friction.

Resistance to Environmental Stress Cracking – Tenite Polypropylene has excellent resistance to stress cracking. No environment has yet been discovered in which stress cracking of polypropylene occurs.

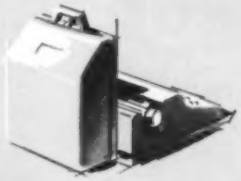
High Gloss – Articles molded of Tenite Polypropylene have a natural lustrous finish, and film extruded of Tenite Polypropylene exhibits a sparkling surface.

Heat Sealability – Tenite Polypropylene is relatively easy to "tack" or "weld." This can be accomplished in many cases with existing equipment.

Printability—With a simple treatment, film of Tenite Polypropylene can be easily printed by conventional methods.

Resistance to Mold and Mildew—Tenite Polypropylene resists the growth of mold or mildew, and is not attacked by insects or marine organisms.

Processability—Tenite Polypropylene has excellent flow properties, permitting good mold-fill in injection molding.

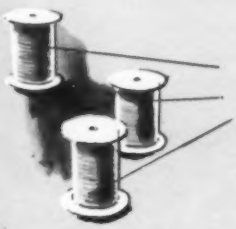


Injection Molding

Tenite Polypropylene can easily be molded into a wide variety of durable low-cost parts with high gloss and surface hardness—for example, appliance housings, automotive accessories, toys and housewares.

Extruded Film and Sheeting

Tenite Polypropylene can be extruded into sparkling clear film and sheeting, with the excellent protective characteristics so important for durable packaging. It can also be extruded in opaque, translucent, or transparent colors.



Monofilament

Tenite Polypropylene can be extruded into monofilament offering high strength, wet or dry, and excellent flexibility at low temperatures. Webbing for outdoor furniture and cordage are among the many possible end uses for this tough material.

Thermoforming

Sheet of Tenite Polypropylene can be used in vacuum forming, pressure forming and skin packaging, with existing equipment.

Wire and Cable Covering

Excellent electrical, thermal, and mechanical characteristics make Tenite Polypropylene desirable for either primary insulation or jacketing. Formulas are available for solid coatings, or for cellular coatings of extra-low dielectric constant.

Pipe

Chemical inertness, resistance to stress cracking, and heat resistance make pipe of Tenite Polypropylene a good choice for industrial use.

Blow Molding

Tenite Polypropylene in special formulations can be blow-molded into many articles possessing exceptional wall strength, resilience, and chemical resistance.

Spools of lustrous red polypropylene filament, extruded for testing purposes in Eastman's development laboratories. Eastman's work over many years in producing plastics of almost unlimited colors has been of significant value in developing superior polypropylene formulations for monofilament extrusion.

A special word about this new polypropylene

The process for manufacturing Tenite Polypropylene was developed by Eastman scientists, engineers and production staff. This exclusive process yields a polypropylene that is superior in several characteristics to other polypropylenes. We base this statement not only on our own laboratory findings but on the opinions expressed by those users who have had the opportunity to evaluate Tenite Polypropylene from our semicommercial plant during the past year.

Since the first Tenite plastic was produced, in 1932, over 42,000 color effects have been formulated in the Tenite color laboratory. This experience, plus pre-eminence in color photography and textile dye technology, enables Eastman to offer the broadest range of colors available in the entire plastics industry. We believe that Tenite Polypropylene represents an improvement in quality and stability of color in this type of plastic. And Tenite Polypropylene color concentrates now offer molders and extruders a clean, easy way to color polypropylene. Use of these concentrates virtually eliminates color contamination and color uncertainty.

We have given you only the highlights on this promising new plastic. For further information, call a Tenite sales office or send this coupon to EASTMAN CHEMICAL PRODUCTS, INC., subsidiary of Eastman Kodak Company, KINGSPORT, TENNESSEE.

This glimpse into the color chip storage room at the Tenite Color Laboratory gives some indication of the variety of colors that has been developed by Eastman since 1932.

Measuring the optical properties of Tenite plastics is but one phase of the diverse and thorough testing done in the Tenite Quality Control Laboratory.

Eastman technical service representatives are ready to work with any customer in finding the most efficient way in which to fabricate products of Tenite Polypropylene.

EASTMAN CHEMICAL PRODUCTS, INC.
subsidiary of Eastman Kodak Company, Kingsport, Tennessee

Please send me more information on Tenite Polypropylene,

for_____
(product or purpose)

Name_____ Title_____

Company_____

Street_____

City & State_____ Tel._____

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POLYPROPYLENE

an Eastman plastic

Other plastics made by Eastman include Tenite Polyethylene, Tenite Butyrate, Tenite Propionate, Tenite Acetate, and Tenite Polyester. Information on any of these materials is also available on request.

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INJECTION MOLDERS!

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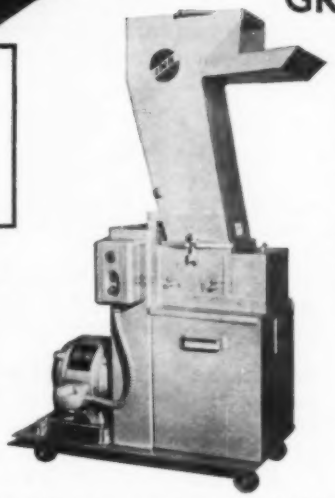
M-3 IMS M-4 GRANULATORS

All machines illustrated here in stock for

IMMEDIATE SHIPMENT



The IMS M-3 6½" x 7" throat sprue grinder — rugged — simple in design — easiest to clean — built-in throat clearance bar — casters — catch pan.

PRICE: Complete with 1 HP Motor and Starter --- $628.50
Same, but with 2 HP Motor ------- $678.00

The IMS M-4 5⅜" x 8½" throat grinder — designed primarily for vinyl, polyethylene, plastisols and all elastomerics where a fine-free low bulk factor product is desired — large throat for large injection molded parts.

PRICE: Complete with 2 HP Motor and Starter $815.00
Same, but with 3 HP Motor $878.00

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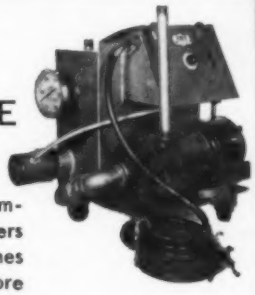

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PRICE: Complete ------ $391.50

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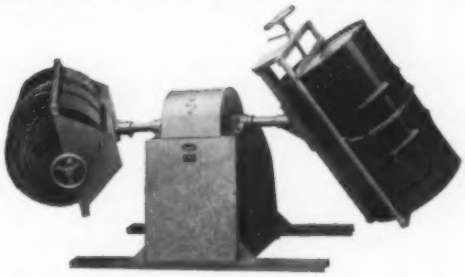

¾ HP Model ---------- $675.00
(Takes drums up to 33" high x 22" in diam.)
1 HP Model --------(same as above)-------- $788.50
2 HP Model ---------- $927.50
(Takes drums up to 37" high x 23¼" in diam.)
3 HP Model ---------- $1285.00
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(Takes drums up to 45" high x 24" in diam.)

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CLEVELAND 28, OHIO

What's new in processing

By spraying an undercoating on materials to be vacuum metallized, processors can increase the durability of heat-reflective gold and aluminum coatings. The organic undercoating, developed by Swedlow, Inc., is a modified silicone. When sprayed on a material or part, it not only provides a smooth, adherent surface for the coating, but acts as a barrier to prevent diffusion of the coating metal into the base. It can be used on ferrous and non-ferrous metals, as well as reinforced plastics.

Air-O-Plastik Corp., Union City, N. J., is using a three dimensional urethane foam cutting process reported to turn out products faster and cheaper than could conventional molding processes. Wood and metal dies compress the flexible foam. A saw cuts off part of the distended foam, and when the die is removed, the foam takes the desired shape. The economy of the process is due to the low cost and ease of fabrication of the dies.

Products cut by the process go under the name Contour-Foam. They can be produced in unlimited varieties of shapes, dimensions, and densities. The company feels that the largest market potential lies in specialized packaging and cushioning needs.

By applying a cement-receptive film to corrosion resistant, rigid PVC sheeting, the processor can bond the sheeting to most substrates. Epoxy adhesive need be applied only to the substrate, thus eliminating multiple surface preparations of sheet and substrate. According to Industrial Plastics Fabricators, material cost is limited to PVC thickness corrosion requirements for the job rather than gage requirements for structural strength.

Abstracts

"Surfacing Sheet Metal with Rigid PVC Sheet" by C. Kubitsky, Plastverarbeiter, December 1960, discusses a method of bonding rigid PVC to steel or aluminum which permits subsequent forming of large parts without damage to the plastic. PVC polymers and copolymers, adhesives, and treatment of the metal surface are included.

"Varnishing Plastics" by W. Wachendorff, Plastverarbeiter, December 1960, outlines methods for improving surface characteristics of plastics for special applications.

"Plasticizing PVC" by A. Passedouet, Pensez Plastiques, November and December 1960, sets up criteria for plasticizer behavior and shows how the five main types—phthalates, low temperature plasticizers, phosphates, polymeric plasticizers, and secondary plasticizers—fulfill the requirements. Consumption of individual products in Europe is compared with consumption in America.

"Operational Behavior of Single Screw Extruders in Processing Polyolefins and PVC" by H. O. Schiedrum and H. Domininghaus, Plastverarbeiter, November and December 1960 and January 1961, briefly considers the theory of screw characteristics in relation to performance. Some measurements are discussed in detail and compared with calculated values. 53 figures.

"What's the Future of Blow Molding" by Mike Kesterton, Progressive Plastics, July 1960, emphasizes materials for processing. Photographs illustrate processing flaws.

Patents

2,960,425 to Owens-Illinois Glass Co. A method for welding thermoplastic sheet by bevelling the edges to be joined and extruding a strip of plastic into the heated groove formed when the sheets are juxtaposed.

2,960,727 to United Shoe Machinery Corp. A method of producing a microporous sintered sheet from discrete vinyl granules.

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CADMOLITH® REDS

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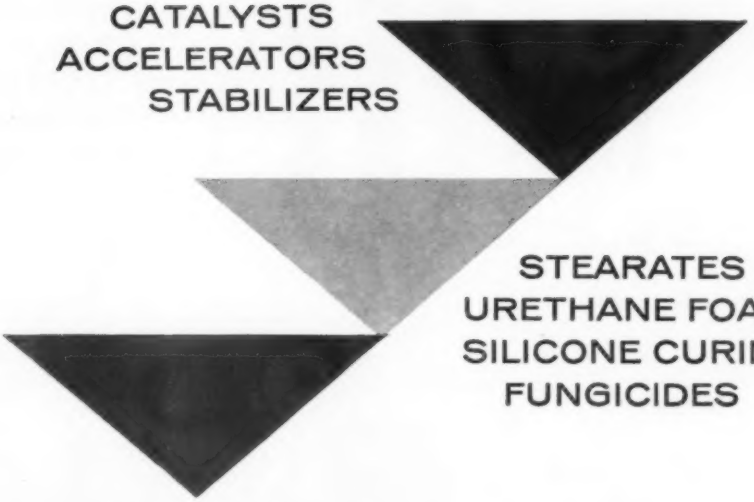

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For a complete listing of Nuodex products, see pages 491-496, inclusive, in Chemical Materials Catalog.

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   Mount more in less space.
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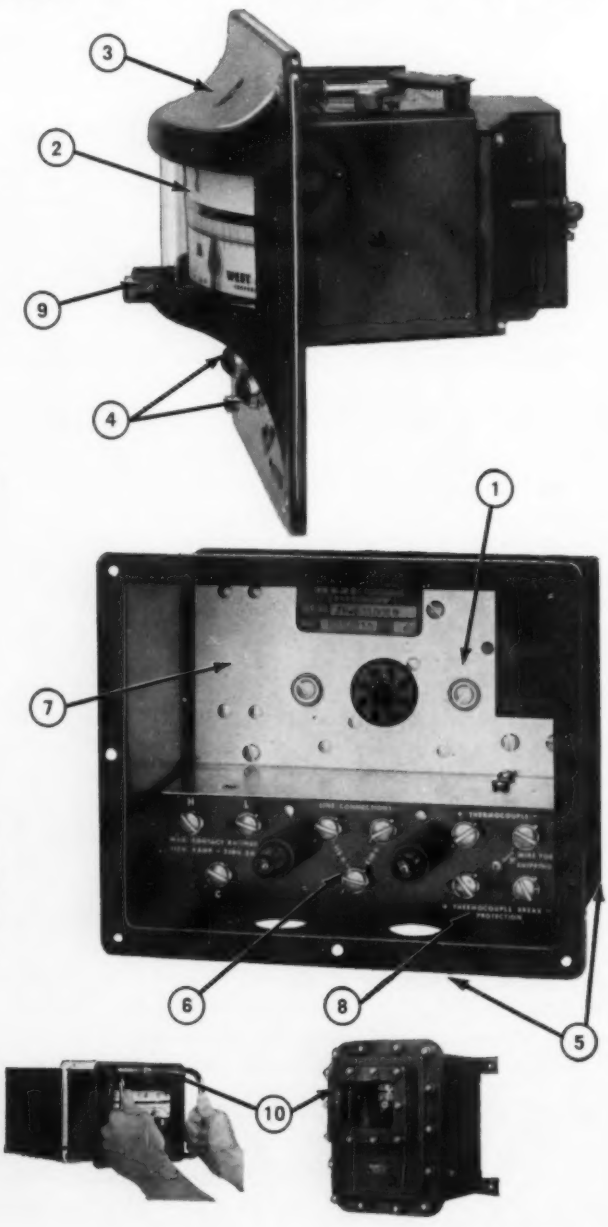

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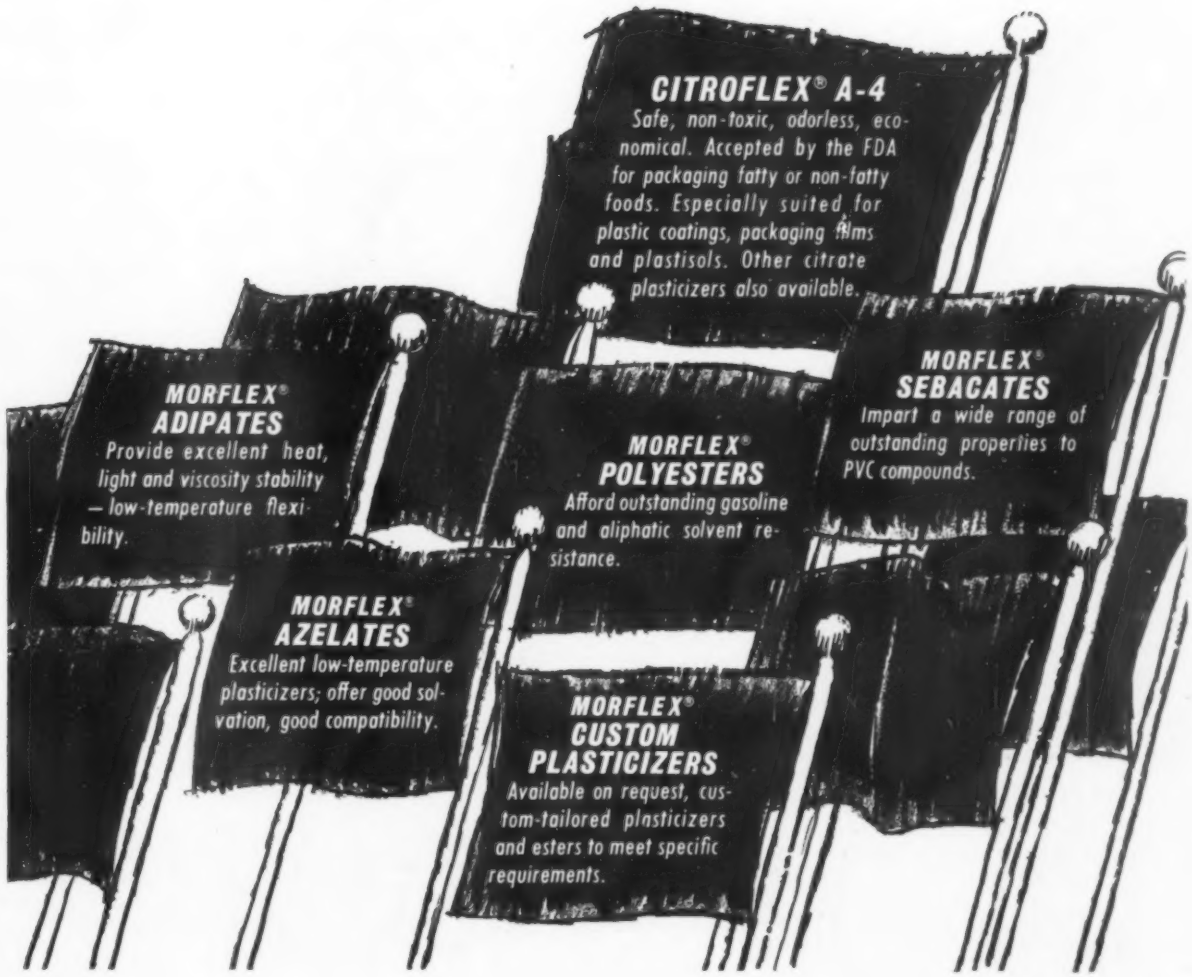
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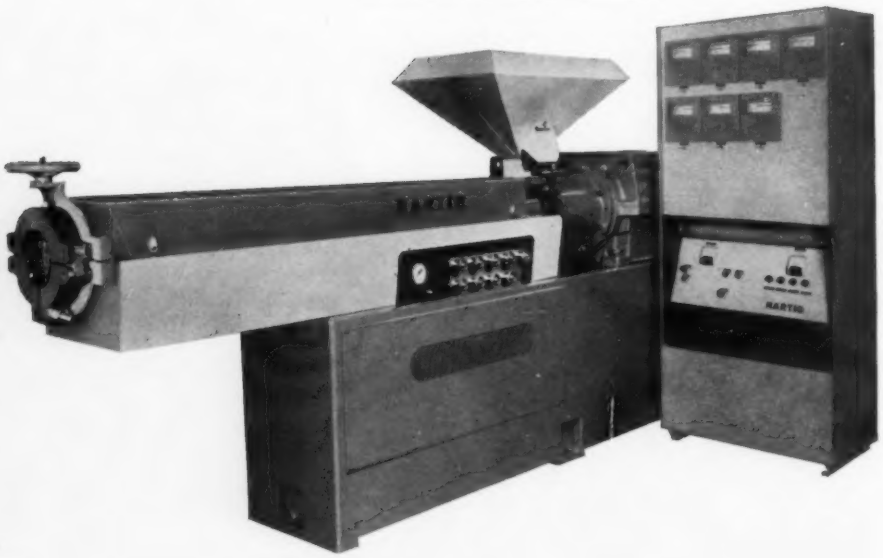

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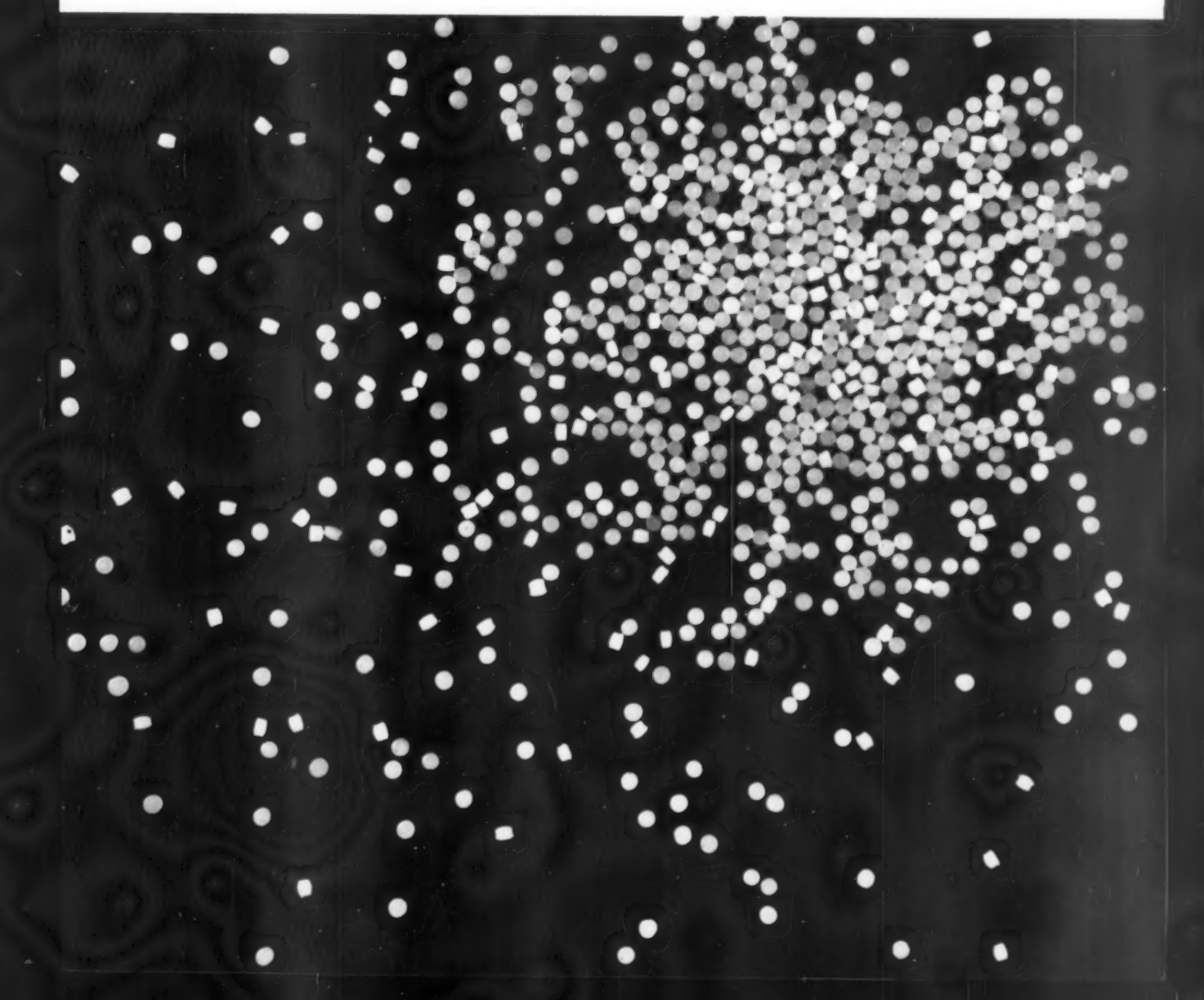

Ameripol—the only high density polyethylene

stronger, beautiful blow molded products

Refrigerator bottles . . . baseball bats . . . detergent bottles . . . flower pots . . . sprinkling cans — whatever you blow mold, you can do it easier and more economically with new Ameripol high density polyethylene from Goodrich-Gulf Chemicals. With Ameripol you get a polyethylene with superior resistance to stress cracking and thermal embrittlement. In fact, all the advantages of a high molecular weight polymer with none of the processing difficulties usually encountered. High density Ameripol handles as easily as conventional polyethylenes . . . uses standard equipment.

And that's not all. Here are other advantages you can expect from Ameripol: *Color*—in an unlimited range of shades. *Finish* that will give your products a beautiful sheen and a smooth, glass-like feel. *Machinability* — easy to cut, groove or punch.

Ameripol is opening up new horizons for plastics processors. See what this new Goodrich-Gulf product can do for you!

that combines durability with processibility

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If you're looking for a tough insulation for wire and cable, Ameripol high density polyethylene is your answer. You're assured of an insulation with excellent dielectric properties and resistance to elevated temperatures . . . a wire coating that virtually eliminates cut-through problems. All this plus easy extruding. You can use this superior material on your standard equipment and insulate wire and cable at commercial production speeds. Results: better products, better profits.

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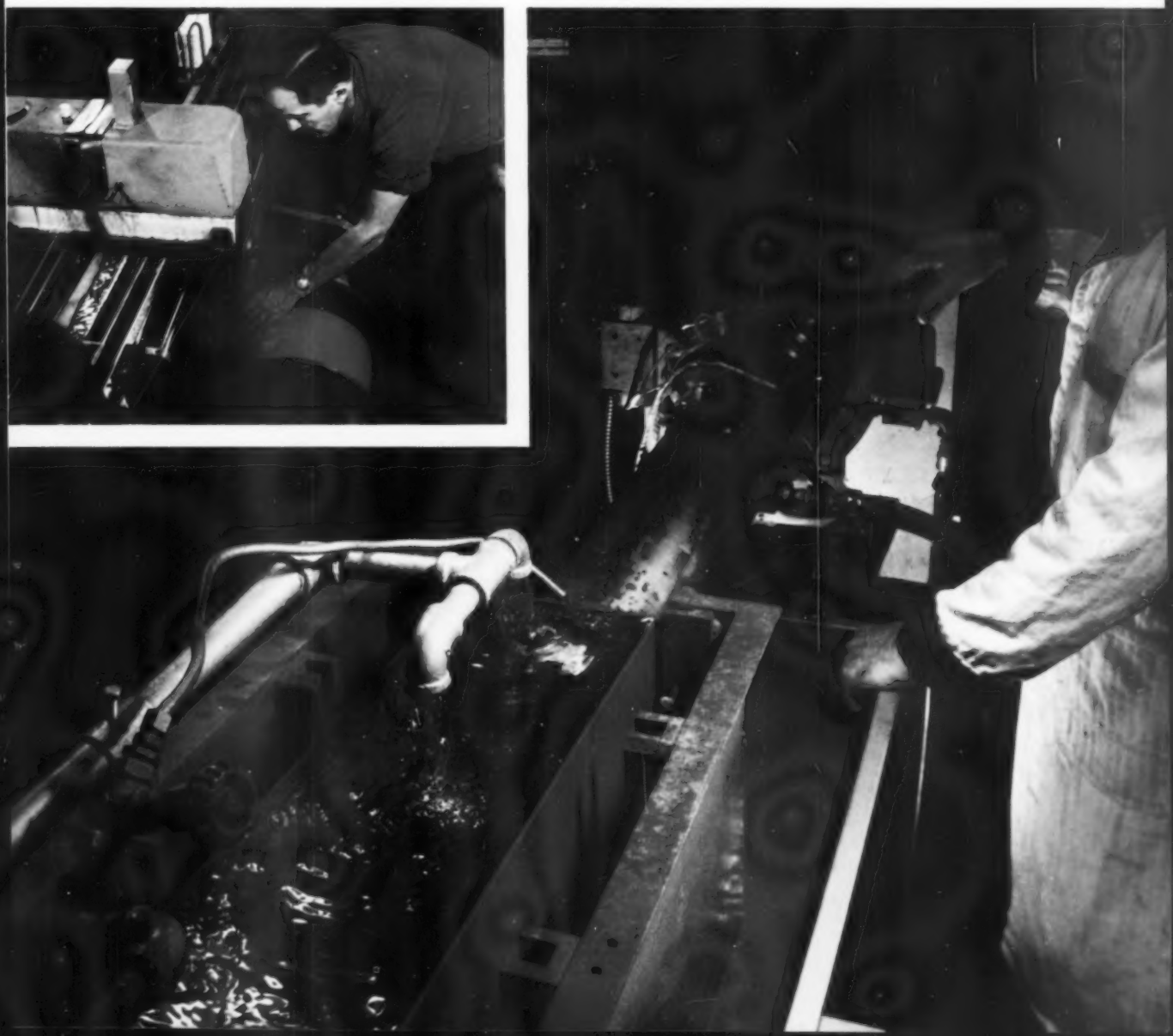
Goodrich-Gulf's unique high density polyethylene proves its distinct superiority as *the* material for plastic pipe. First, you'll find this high molecular weight Ameripol Polyethylene produces a *smoother* pipe, and this means faster production, bigger output.

Ameripol Polyethylene resists contamination, keeps pipe lines pollution-free. It produces pipe that resists cracking under stress, withstands impact, is easy to install. And Ameripol requires no special costly equipment or special dies. Put Ameripol Polyethylene to work for you now.



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Physical Property	ASTM Units	ASTM Method	AMERIPOL GRADE NO. 32	34	35
Density	g/cc	D648-56	0.95	0.95	0.95
Molecular Weight	———		50,000	80,000	100,000
Melt Index (condition E)	g/10 min	D1238-57T	0.1-0.2	0.04-0.08	0.001
Flow Index (a) (condition F)	g/10 min	D1238-57T	24.0-28.0	8.5-9.3	4.0-5.6
Intrinsic Viscosity	———	D1601-58T	2.3-3.0	3.1-3.7	3.8-4.8
Vicat Softening Temperature	°C	D1525-58T	119	121	122
Ultimate Tensile Strength, 20 ipm	psi	D412-51T	2250	2450	2700
Tensile at Yield, 20 ipm	psi	D412-51T	3450	3450	3450
Elongation, 20 ipm	%	D412-51T	120	320	560
Impact Strength (b)					
⅛ x ½ bar	ft/lbs				
	in notch	D256-54T	19	31	36
¼ x ½ bar	"	D256-54T	8	17	24
½ x ½ bar	"	D256-54T	0.9	1.9	4.3
Stiffness in Flexure	psi	D747-50	115,000	115,000	120,000
Hardness	Shore D	D1706-59T	60	60	60
Environmental Property					
Environmental Stress Cracking (c)					
With Anti-oxidant	hrs.		65	445	>800
Without Anti-oxidant	hrs.	D1693-59T	40	230	500
Thermal Embrittlement (d)					
With Anti-oxidant	hrs.	(d)	185	>1000	>1000
Without Anti-oxidant	hrs.	(d)	70	95	700

(a) Cutoff on flow index test made at the end of 30 seconds.
(b) The impact strength test result is greatly influenced by sample size.
(c) ASTM Standard on Plastics, D1693-59T Method of Test for Environmental Stress Cracking of Type I Ethylene Plastics. This test, which has been adopted for Type I Ethylene Plastics is used herein for Type III in the absence of an official method.
(d) This test employs compression molded specimens, 5" x 0.25" x 0.05", three of which are wrapped and clamped around a ¼" mandrel. The apparatus is inserted in a nitrogen blanketed test tube which in turn is placed in an aluminum block @ 100°C. The value reported is the time until two of the three samples crack.

How to put this new polyethylene to work in your operation

It's easy. A call to Goodrich-Gulf Technical Service is all that's needed. An experienced sales engineer will come out to your plant and help you select the right grade of Ameripol for your product. You'll find that Goodrich-Gulf has the technical know-how to handle every aspect of your high density polyethylene needs – from application and production to shipping and storage. See how better products start with Ameripol high density polyethylene – Write for your Ameripol Technical Data file now!

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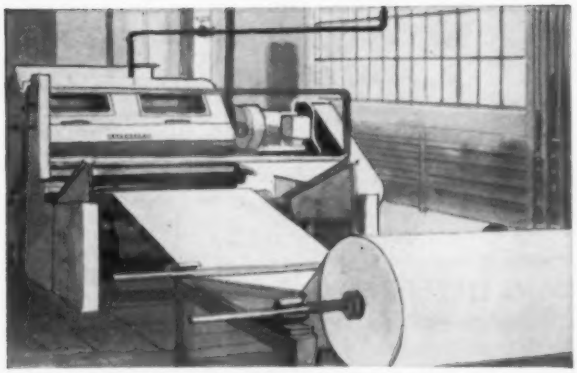
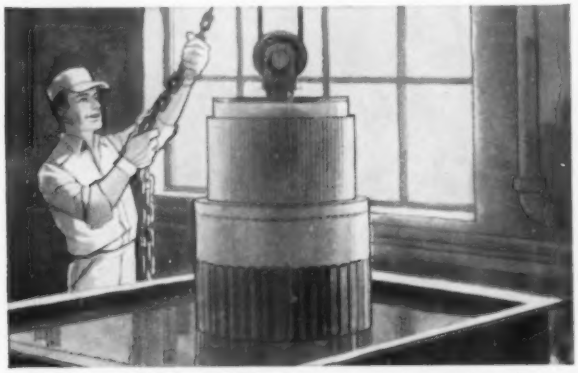


Control uniformity of film thickness in vinyl plastisol and organosol coatings for paper or cloth, with BENTONE 27 or BENTONE 38 gellants.

Control penetration on porous surfaces—the right BENTONE gellant will minimize "wicking" of resin coatings on cloth, paper, concrete.



Minimize sagging and running when dip-coating electrical parts with epoxies. BENTONE gellants help control flow during dip and cure.

Control suspension of pigments, extenders, fillers in polyester gels and gel coats. BENTONE 27 gellant provides thixotropic flow control during application.

4 plastic coating problems you can solve with BENTONE® 27 or BENTONE® 38 gellants

Here are only a few of the many problems you can solve with two BENTONE® gellants—especially those problems involving efficient control of viscosity, particle settling, penetration or flow properties.

You can pinpoint the precise viscosity needed for best results with epoxies, polyesters, vinyl dispersions—by "building in" the right BENTONE gellant. Generally, BENTONE 27 gellant is for use with high polarity solvents. BENTONE 38 gellant works best with low to medium polarity compounds. Both provide highly efficient particle suspension and contribute to control of uniformity in color, film thickness and other physical properties.

Many advantages in application, curing and storage. Better dip coating—with little or no sag during cure. Spray coatings have uniform suspension properties—improved color uniformity. Adhesives and other coatings have effective penetration control—and reproducible viscosity control.

BENTONE gellants work well with many solvents—including aromatic and aliphatic hydrocarbons, esters and ketones. Gels produced by BENTONE gellants are stable in storage—no separation of components or gel contraction.

To get helpful information quickly, clip the coupon below, check your areas of interest, and drop it in the mail today.

Visit our Booth #335 at the Plastics Show

NLC

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In Canada: **CANADIAN TITANIUM PIGMENTS LIMITED**
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KC-9892-B

Please send information on BENTONE 27 and BENTONE 38 gellants for applications checked below:

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NEW low-oriented styrene for extra strength in thin walls . . . latest in impact styrenes.

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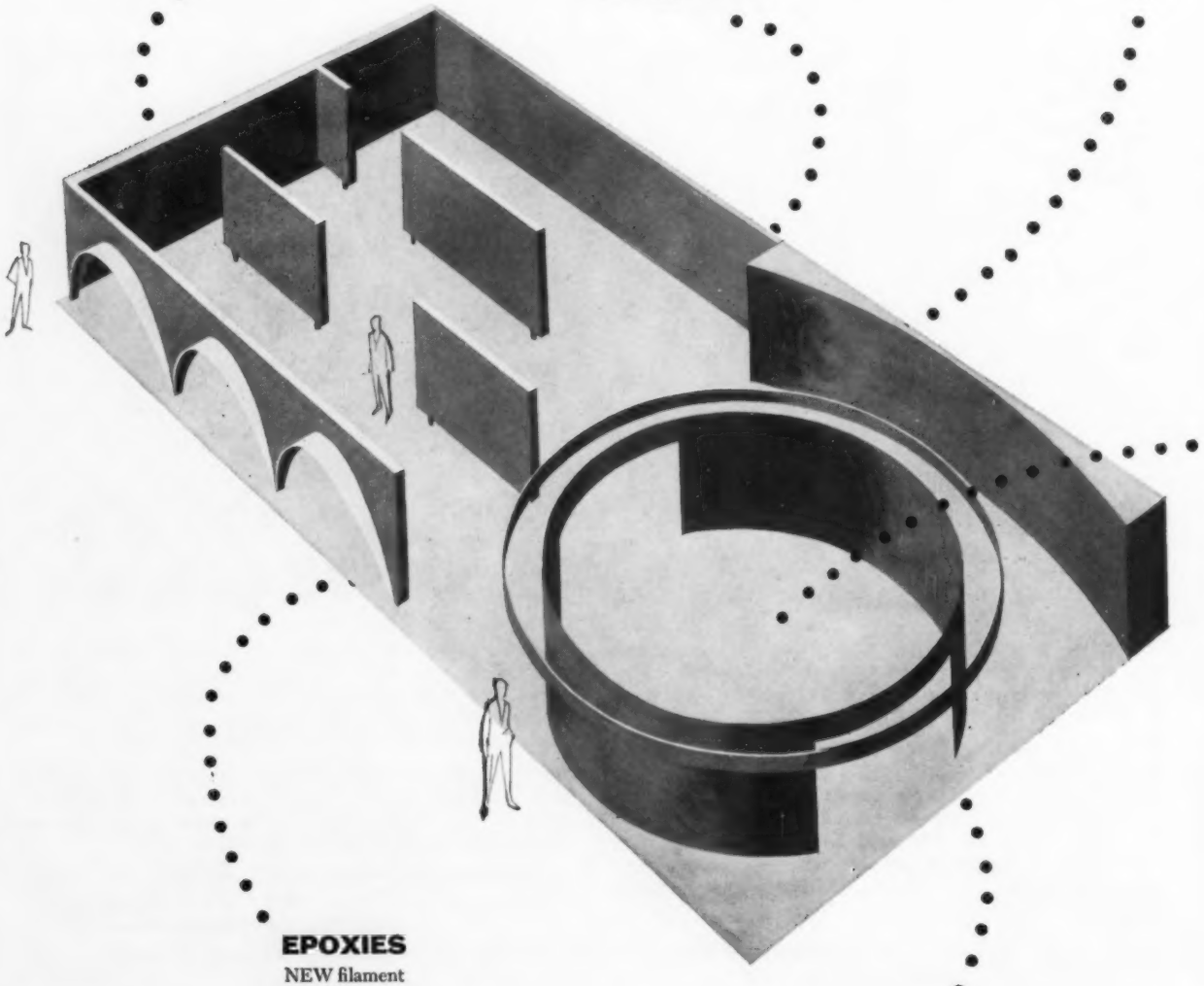

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NEW plastisol resins and techniques . . . wire and cable applications . . . luminous ceilings . . . metal coatings.

Don't miss the Union Carbide Plastics Exhibit at the Show!

See how this broad range of plastics—backed by 50 years of leadership—can help improve your products and profits!

Polyethylenes . . . epoxies . . . phenolics . . . styrenes . . . vinyls. The latest process developments and product applications in Union Carbide's family of highest-quality plastics will be on display at the Plastics Show.

See for yourself how UNION CARBIDE's broad product line, service and development skills can serve you.

Remember the place: New York Coliseum. The dates: June 5 to June 9. *The* exhibit to see at the Plastics Exposition: UNION CARBIDE PLASTICS, Booth 1028.

Union Carbide Plastics Company, Division of Union Carbide Corporation, 270 Park Avenue, New York 17, N.Y. *In Canada:* Union Carbide Canada Limited, Toronto 12.

UNION CARBIDE

Motor display made by Moldcraft Inc. for Johnson Motors, Outboard Marine Corp. Plastisol formulated by A. P. Nonweiler Co.

Monomer X-970 raises hardness and heat distortion temperature of vinyl products

This outsized outboard motor is a rigid display piece, made from a plastisol fortified with Rohm & Haas MONOMER X-970. Its hardness and rigidity would be difficult if not impossible to obtain with an ordinary plastisol formulation.

MONOMER X-970, a thermosetting modifier for PVC plastisols, is a high-boiling, low-viscosity ester that can be polymerized by heat or catalysts to a cross-linked polymer. Here's what it does when added to your plastisol: (1) it actually lowers the viscosity of your formulation, and (2) through thermosetting action, it gives you a much harder product than you could get without it. Finished pieces have good impact strength and outstanding resistance to deformation by heat.

Plastisols modified with MONOMER X-970 show these properties: (1) workable viscosity even at low plasticizer levels, (2) practical working life, (3) adaptability for use in rotocasting, slush molding or coating. Their low viscosity permits easy filling of finely-detailed molds, and provides even distribution of material to give pieces with uniform wall thickness. Cure is accomplished at ordinary fluxing temperatures. Rigidity of finished articles allows mold release at higher than usual temperatures—this results in speedup of production cycles.

Write to Dept. RP-4 for complete technical information and sample of Monomer X-970.

ROHM & HAAS

PHILADELPHIA 5, PA.

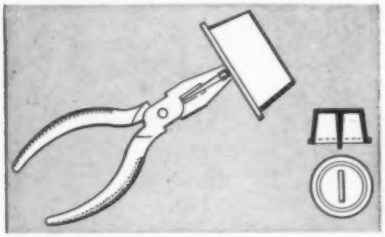
U.S.I. POLYETHYLENE NEWS

A series of advertisements for plastics and packaging executives by the makers of PETROTHENE® polyethylene resins

MAY, 1961 U. S. Industrial Chemicals Co., Division of National Distillers and Chemical Corporation 99 Park Ave., N.Y. 16, N.Y.

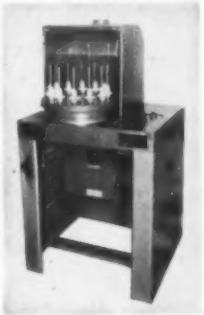
Packaging Notes

Polyethylene pull plugs have fixed place to grip, so they're easy to remove and install with either fingers or pliers. Typical uses, according to the manufacturer, are: protection of pipe; tube and



hydraulic fittings; testing and shipping; sealing dirt-and moisture-catching openings; masking when spray painting, dipping or plating. Sizes range from ¼" to 3"; color is standard "caution" orange. Company also offers polyethylene tube caps, finishing flanges, flat washers.

Electronic bombardment of polyethylene bottles–to make their surface more receptive to printing inks–is claimed to be fast and efficient with an Italian-made machine about to be introduced in the U. S. A. Toys and other hollow polyethylene products, as well as bottles of any size or form, can be treated. Specifications include: output up to 2000 pieces per hour, depending upon product and model; built-in ventilation hood; push-button controls; spring-wire electrodes.



Automatic date and price coder developed specifically for the bakery trade is being marketed as an accessory to the maker's polyethylene bag-sealer. It reportedly stamps each sealed bag clearly and legibly, although package itself may be uneven. Imprinting foot actually moves the wrapped item, so spacing is of no importance.

BE SURE TO VISIT THE
U.S.I. EXHIBIT – BOOTH 304
NATIONAL PLASTICS
EXPOSITION
NEW YORK COLISEUM, JUNE 5-9
NEW YORK CITY

Polyethylene Tomorrow: Theme of U.S.I. Exhibit At S.P.I. Exposition

To Focus On New Opportunities For Profit

For a depth analysis of the problems and opportunities of processing with polyethylene in the years immediately ahead, visit U.S.I.'s Booth 304 at the 9th National Plastics Exposition. The show sponsored by the Society of the Plastics Industry, Inc., will be held June 5-9 at the New York Coliseum.

Market Advances Displayed

U.S.I. will provide dramatic market-by-market forecasts of polyethylene supply and demand through 1963. Specially-constructed displays will show increases anticipated in each of five areas–film extrusion, coating and laminations, injection and blow molding, wire coating and pipe extrusion, and molding with powdered polyethylene.

Breakthroughs Featured

Samples of important new polyethylene products made by the various processing techniques will be on display. Such products, which illustrate the versatility of polyethylene, are contributing substantially to market growth . . . creating new profit opportunities. Typical and on exhibit for the first time: boats molded of U.S.I.'s "Microthene" finely-divided polyethylene resin. Other items show applications ranging from packaging to construction to toy and novelty products.

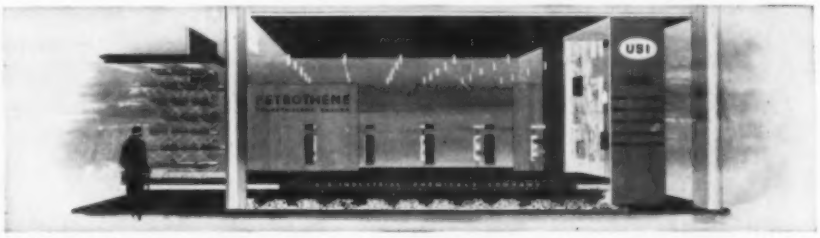
Technical Experts to Interpret

U.S.I.'s technical service representatives and market analysts will be on hand to answer questions and interpret trends. These experts have the know-how to help solve production problems and help guide processors to maximum profit.

Products Arrive As Shipped In Polyethylene-Lined Mailing Bags

Polyethylene-lined mailing bags are ideal for shipping samples or small quantities of products requiring moisture protection or retention. Dehydrated food, flour and chemicals are examples of the former; plant food, of the latter. Filling is manual or automatic. Liner, which extends slightly above bag mouth, is banded, wire-tied, or heat-sealed closed; then pushed down into cotton outer bag.

U.S.I. To Participate In British Plastics Show



New equipment will be U.S.I.'s main attraction at INTERPLAS 1961, the British Plastics Exposition to be held at the Olympia, London, England, June 21-July 1. U.S.I. will occupy Booth B-209, on the first floor of Hall B (National).

On center stage will be the "MA Packaging System" which provides inexpensive, in-plant packaging for a variety of products. This system shows promise of increasing the market for polyethylene film. The M A System utilizing a shrink tunnel will be packaging the International Edition of the New York Times as a gift to visitors to the booth.

Samples of other polyethylene products, too, will be shown: blown and cast film; rolls of polyethylene-coated substrates–foil, paper, polyester and cellophane; injection molded products; such new blow-molded items as a miniature wine flask, toy doll parts and garden ornaments.

Also offered for the first time will be a new edition of U.S.I.'s detailed processing guide for all polyethylene processors. It is published in English and will soon be available in German and Spanish as well.

U.S.I.

Series VI, No. 3

POLYETHYLENE PROCESSING TIPS

TRANSMISSION OF MOISTURE VAPOR THROUGH POLYETHYLENE FILMS AND COATED PAPER

Polyethylene film and coated paper are often selected as packaging and construction materials principally because they provide a moisture barrier.

In packaging hygroscopic materials such as powdered foods, sugar, flour and dry chemicals, moisture pick-up must be prevented. Metals, too, require protection from moisture, which accelerates corrosion.

In construction work, polyethylene film and coated paper are used to seal off moisture under buildings, in sidewalls, and under concrete floors and driveways.

In some cases, moisture *loss*, rather than pick-up, may be the problem. Bread and baked goods need moisture to remain fresh. Cellulose sponges are packaged damp to keep them soft and pliable, and this moisture must be retained during the shelf life of the package.

Conditions Determine Requirements

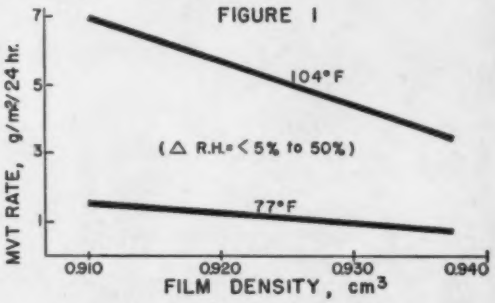
For any packaging application, the required degree of resistance to moisture penetration depends on the nature of the product and where it is stored and used. In selecting a particular polyethylene film or coated substrate, one should consider: (1) the amount of moisture gain or loss allowable through the polyethylene and (2) the environmental conditions which will be encountered. These will determine the permissible moisture vapor transmission rate for the film. With many products, moisture barrier requirements may be so non-critical that any polyethylene film or coated substrate that can be used to package them will also provide a satisfactory moisture barrier. With many packages, seams, corners, or stitching may be a bigger factor with respect to moisture vapor transmission than the barrier properties of the polyethylene itself.

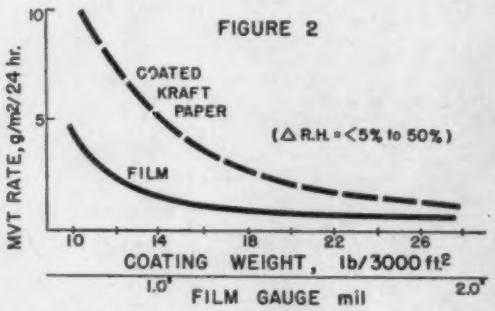
Factors in Moisture Vapor Transmission

By definition, moisture vapor transmission (MVT) is the rate of water vapor permeation through a barrier under given conditions of temperature and relative humidity. MVT is measured in grams of water vapor penetrating one square meter of film or coated paper in 24 hours. Test conditions (ASTM E 96-53T) call for 73°F temperature, with 50% relative humidity on one side of the sample and less than 5% on the other.

Figure 1 shows the effect of film density and environmental temperatures on the MVT rates of 1-mil film. To decrease the MVT rate, it is necessary to increase film density or decrease the environmental temperature.

Figure 2 shows the effect of film thickness and coating weight on MVT for polyethylene resins of .920 g/cc density.





The higher vapor transmission of coated paper is due primarily to "wicking," for at low coating weights paper fibers may extend through the thin coating. At higher coating weights, "wicking" will not occur, and polyethylene films and coatings of equal thickness will have essentially the same MVT rates. Barrier properties of the substrate are also important. Foil, for example, has a very low MVT rate and is often used in laminated materials for critical military packaging.

The greater the difference in relative humidity across the barrier, the higher the MVT rate. Thus, dry packaged materials will need more protection in high-humidity environments. MVT rates vary linearly with the difference in partial pressures of water vapor across the barrier, except for thin coatings where "wicking" may occur.

U.S.I. Help on MVT Problems

Greater economy may well result from use of the proper film density and thickness. For assistance in finding the best resin or film for given applications, contact the nearest U.S.I. Sales Office. Your problem will be referred promptly to U.S.I.'s Technical Service Department.

U.S.I. INDUSTRIAL CHEMICALS CO.
Division of National Distillers and Chemical Corp.
99 Park Ave., New York 16, N. Y.
Branches in principal cities

Editorial: Ninth National Plastics Exposition

If, in looking over this issue, you think we are plugging SPI's 9th Annual Plastics Exposition and Conference you are perfectly right. We are! The only real reason for a trade publication's existence is service to its industry, and we would be doing you a distinct disservice if we did not use every means at our disposal to point out its value.

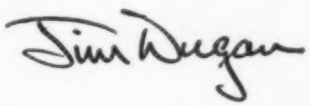
Ours is a rapidly growing industry, and the circulation of information should not and cannot wait for the conventional sources. You cannot run a plastics processing business on textbook knowledge. Much of the know-how is passed along by direct verbal communication, and what better opportunity for such interchange than the National Plastics Show?

Everything and everyone is literally at your disposal. The show takes place every 2½ years, and it would take you most of that intervening time — traveling all over the country — to see the machines and materials, and to discuss them in terms of your own problems and needs. Here, you have them all together under one roof. All you have to do is budget your time.

To assist you in this, we have assembled a special section describing the conference program, listing exhibitors by company and by products shown, offering some suggestions on pre-planning your trip so as to get the most out of it, and running the floor plans of the exhibit hall. The latter can be very useful if properly used. So much time and energy can be wasted by wandering up one aisle and down the other. We have color-coded the plans to indicate whether an exhibitor is a machinery supplier, a materials producer, or a processor. The code letters A through H indicate the process areas which would probably be served by the exhibitor's products, i.e. — injection, extrusion, blow molding, etc. This way, you can check off in advance the exhibits you most want to see and save a lot of footsteps in finding them.

If we at PLASTICS TECHNOLOGY can be of any help, please look us up. We will be in Booth 405 on the ground floor. We're open to any and all questions. If we can't answer them, we will do our best to direct you to the proper source. And don't forget to offer any suggestions you might have about the magazine — any and all comments will be most gratefully received.

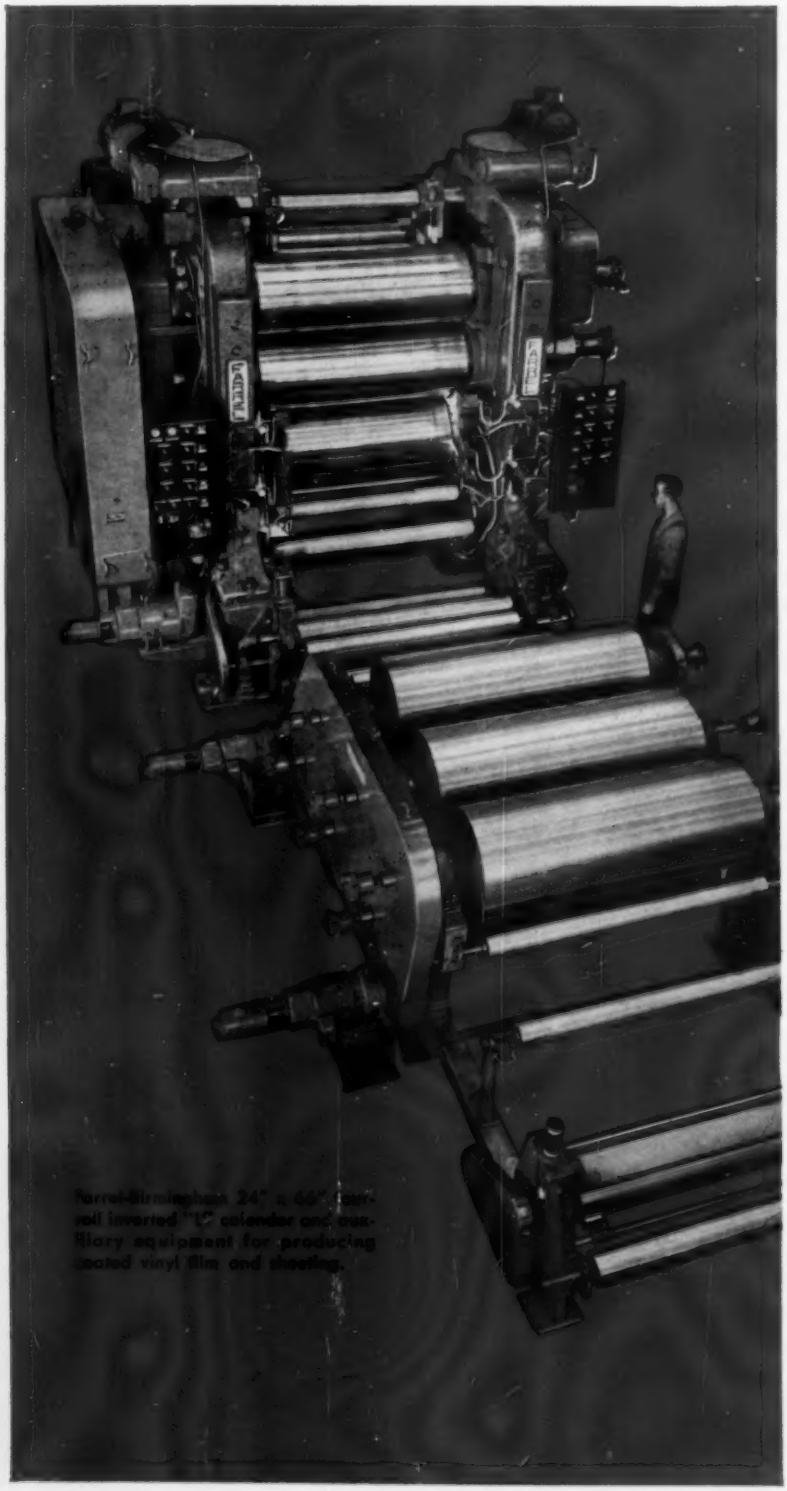
One last remark. A friend of mine recently remarked out in Chicago that he didn't see how he could afford the time to attend. I remarked that I didn't see how he could afford not to. This, in essence, sums up our feelings on the Exposition.



Editor

DUAL-PURPOSE CALENDER TRAIN

maintains accuracy in producing and coating vinyl film and sheet



Farrel-Birmingham 24" x 66" four-roll inverted "L" calender and auxiliary equipment for producing coated vinyl film and sheeting.

The calender train shown here was designed by Farrel-Birmingham for producing vinyl film and sheeting, and then coating them with butyl rubber at speeds up to 80 yards per minute. The calender has a motorized crossed-axes device which accurately compensates for roll deflection under the varying conditions of calendering film, sheet and finished product, assuring extremely close gauge control for the final pass for each. A heating and cooling system is furnished to provide the necessary heating range for vinyl material and also the moderate temperatures required for butyl.

Vinyl film is produced in the first operation, then stored in rolls which are later unwound for the coating process. A freshly calendered butyl sheet is laminated with the vinyl film or sheet, after which the combination is cooled, wound up, and subsequently slit into tape-width strips for delivery. The finished product is used for covering underground pipe lines.

The calender train includes a 24" x 66" four-roll inverted "L" calender, film and sheeting let-off, adhesive coater, two-roll laminator, six cooling rolls, beta-ray gauge, trimming unit and double center windup unit. The calender is driven by a 200 HP motor with adjustable-voltage control. Complete synchronization is provided for all train units.

A Farrel engineer will be glad to help you select a calender for your specific needs. Call today.

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ANSONIA, CONNECTICUT

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European Office: Piazza della Republica 32, Milano, Italy

FB-1186

FARREL

Non-Toxic Vinyls?

Now all vinyls—*even rigids*—can be made non-toxic with one of the 3 new F&DA approved Argus stabilizers: Mark 33, 34, and 35.

Each, used in its specific applications, gives stability superior to that of any non-toxic stabilizer available. All 3 withstand the extremely high heat needed to process rigids. And are finding wide application in calendered, extruded and molded vinyls for the food, drug and baby product fields.

Toxicity is only one of dozens of technical problems put to Argus each week. Flexibility at low temperatures, plastisol bubble break, and better stabilization of electrical compounds and of clear rigids are other frequent posers. Argus finds the answers. Either in existing Mark stabilizers and Drapex plasticizers, or through research in our lab.

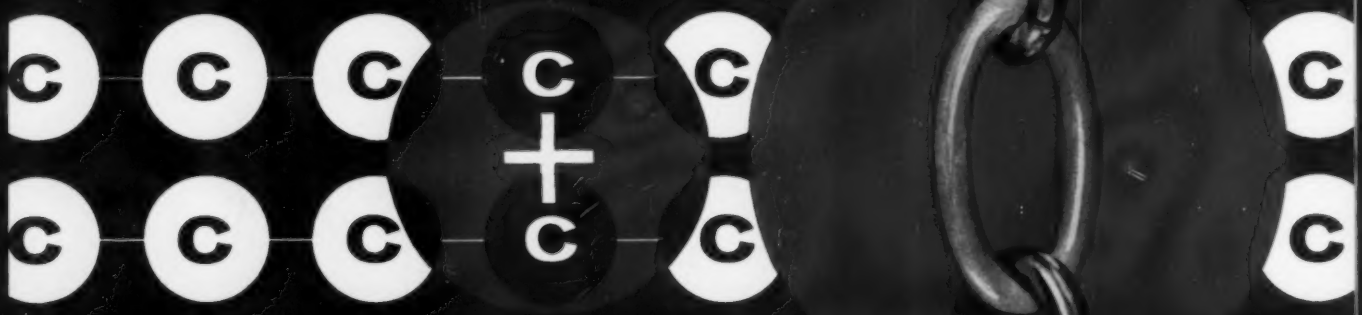
Don't keep *your* problems to yourself. Call Argus.

Argus Has the Answer

Technical bulletins and samples on request

ARGUS CHEMICAL Corporation 633 Court Street, Brooklyn 31, N.Y. Branch: Frederick Building, Cleveland 15, Ohio

Rep's.: H. M. Royal, Inc., 11911 Woodruff Ave., Downey, Cal.; Philipp Bros. Chemicals, Inc., 10 High St., Boston; H. L. Blachford, Ltd., 977 Aqueduct St., Montreal.
European Affiliates: SA Argus Chemical NV, 33, Rue d'Anderlecht, Drogenbos, Belgium—Lankro Chemicals, Ltd.; Salters Lane, Eccles, Manchester, England.



DI-CUP®... *Key Link in Cross-Linking Polyethylene*

Di-cup, Hercules dicumyl peroxide, is a source of free radicals, which are highly effective in chemical cross-linking. It provides a simple, economical, and practical means of cross-linking low-density polyethylene.

Cross-linked polyethylene is a thermoset material resistant to softening and deformation at high temperatures. It shows no evidence of environmental stress cracking and it is resistant to many solvents at high temperatures.

This development opens new markets for products that require superior toughness, flexibility, impact strength, and chemical resistance.

For more information on Di-cup, write

Oxychemicals Division
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HERCULES POWDER COMPANY
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Tell me more about Columbian Carbon Blacks for plastics!

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LIGHT STABILITY OF STYRON® VERELITE® IN FLUORESCENT-LIGHTING DIFFUSERS

A major problem with polystyrene plastics commonly used in designing fluorescent light diffusers has been early yellowing. As engineers know, this is essentially an oxidation type process, and the degree of yellowing (or loss of light transmittance) is a measure of the molecular breakdown of the plastic. With unstabilized plastics, degradation can be so severe as to cause warpage, distortion and reduced strength.

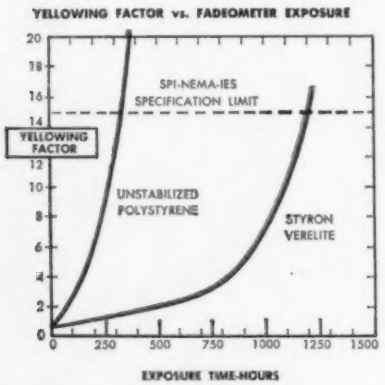

Fig. I —Improved stability of Styron Verelite

The villain in the piece is primarily ultraviolet radiation from the fluorescent tube. The presence of U.V. radiation greatly speeds the oxidation process, in which oxygen breaks the carbon-hydrogen bonds. By the use of suitable additives, however, polystyrene formulations can be produced which will stand up for many years before the degree of yellowing reaches industry limits. One such material is Styron Verelite polystyrene.

Discoloration limits have been agreed upon by a joint industries lighting committee—The SPI-NEMA-IES*. The maximum tolerable yellowing limit set by the committee is expressed as a yellowing factor of 15. Yellowing factor is determined by the equation:

$$\text{Yellowing factor} = \frac{(T_{420_B} - T_{420_E}) - (T_{680_B} - T_{680_E})}{T_{560_B}} \times 100$$

where T = % light transmission at given wave length
B = blank
E = exposed

In shorter-term Dow studies on methods of improving light stability of polystyrene plastics, the Atlas Fadeometer is used for purposes of accelerating test results. This device has a carbon arc light source which provides light of essentially the same frequencies U.V. radiation as cool white fluorescent light tubes, but at much higher intensities. A correlation has been established between exposure in this machine, and actual long-term exposure to cool white fluorescent tubes, at varying diffuser-to-tube distances. For example, 1250 hours' exposure in the Fadeometer is equivalent to approximately 4½ years' continuous exposure in a light fixture with half-an-inch clearance between the plastic diffuser and a cool white tube. With increased spacing the discoloration rate is even slower.

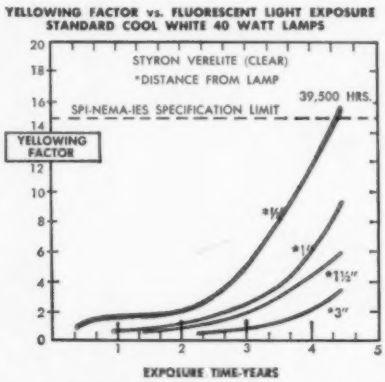

Fig. II—Effect of clearance space on rate of discoloration.
Note similarity for curves (Fadeometer and ½" spacing in fixture)

On the basis of these data—accelerated aging in the Fadeometer and performance in actual installation—Styron Verelite has proven suitable for fluorescent light diffuser paneling. Using the industry average of 60 hours per week, satisfactory performance for as long as 10 years can be expected.

Dow Plastics Technical Service Engineers have developed considerably more data on Styron Verelite as a light diffuser material. Included are the new translucent whites and more recently the high intensity lamps. For information on the results of these studies, and on the selection and application of other Dow molding materials in design work, write THE DOW CHEMICAL COMPANY, Midland, Michigan, Plastics Sales Dept. 1732DT5.

The Society of the Plastics Industry—National Electrical Manufacturers' Association—Illuminating Engineering Society.

AMERICA'S FIRST FAMILY OF THERMOPLASTICS

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THE DOW CHEMICAL COMPANY DOW Midland, Michigan

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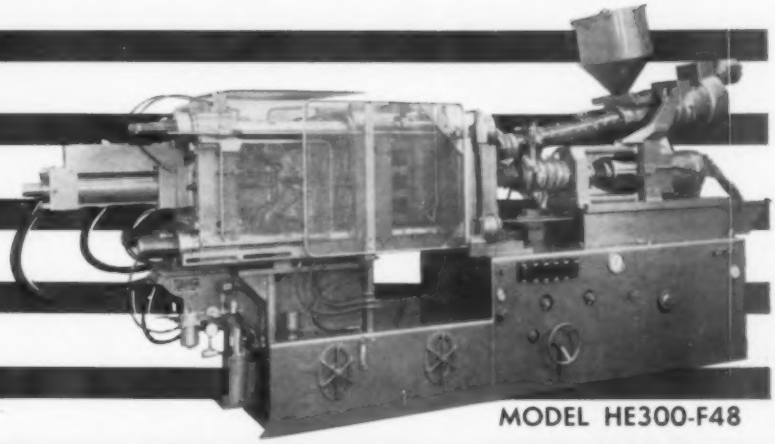
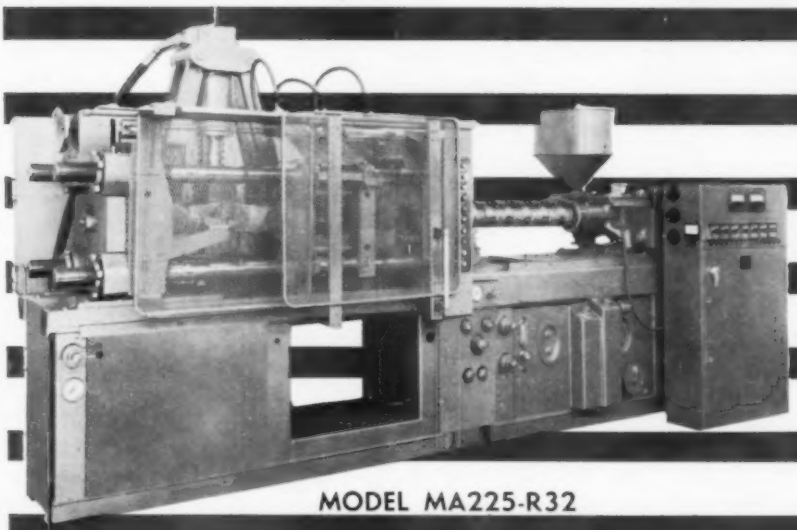


MODEL HE300-F48



MODEL MA225-R32

AT THE 9th NATIONAL PLASTICS EXPOSITION in NEW YORK June 5-9

To meet the needs of the plastic molding industry, Impco offers a complete line of screw plastifiers. Various design adaptions for this type of plastifying are now available cn nearly all of our machine models. Two of these adaptions will be on display at the Plastics Show in June. See them operating at the Coliseum, June 5-9, or send for additional information. We will be happy to discuss these and other significant improvements to the accepted leading make of injection molding machines.

IMPCO®

IMPROVED MACHINERY INC.

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KILLION TOOL AND MANUFACTURING COMPANY

Verona, New Jersey

PLASTICIZERS FOR VINYLS THAT REALLY GO PLACES

In 1960, for the second successive year, vinyls shared the honor of being one of only two plastic materials to break the billion-pound-per-year mark.

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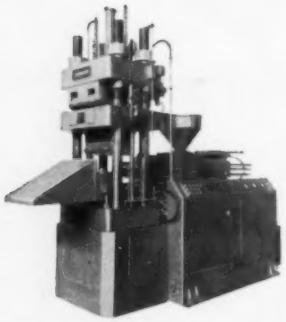

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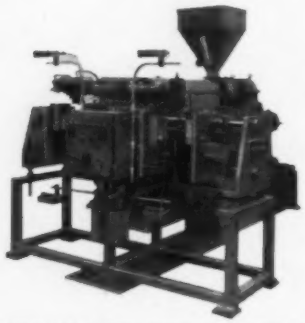
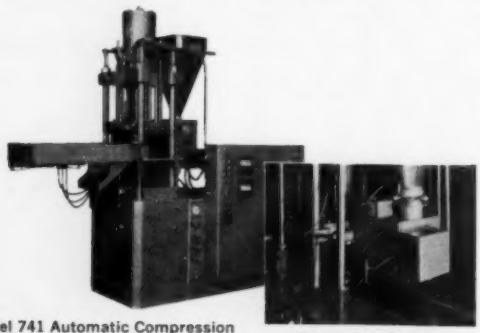


Model 855-2 Blow Molder with extruder



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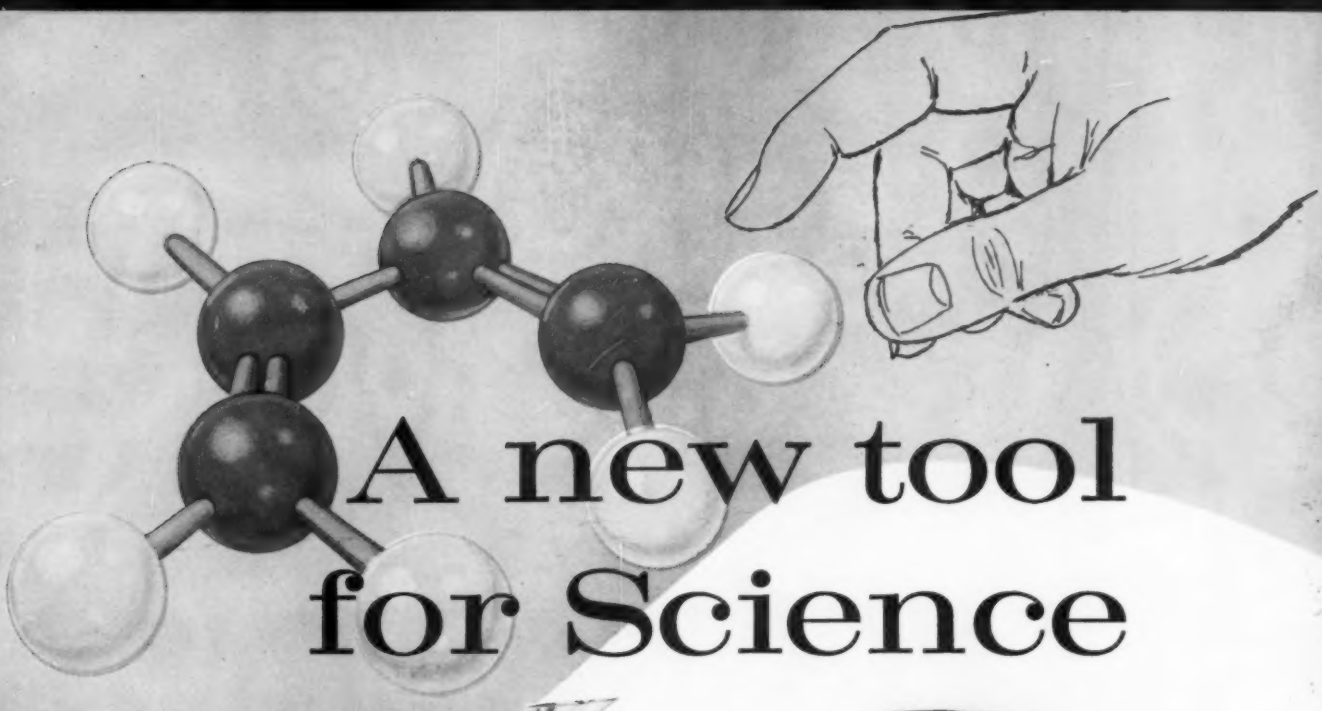

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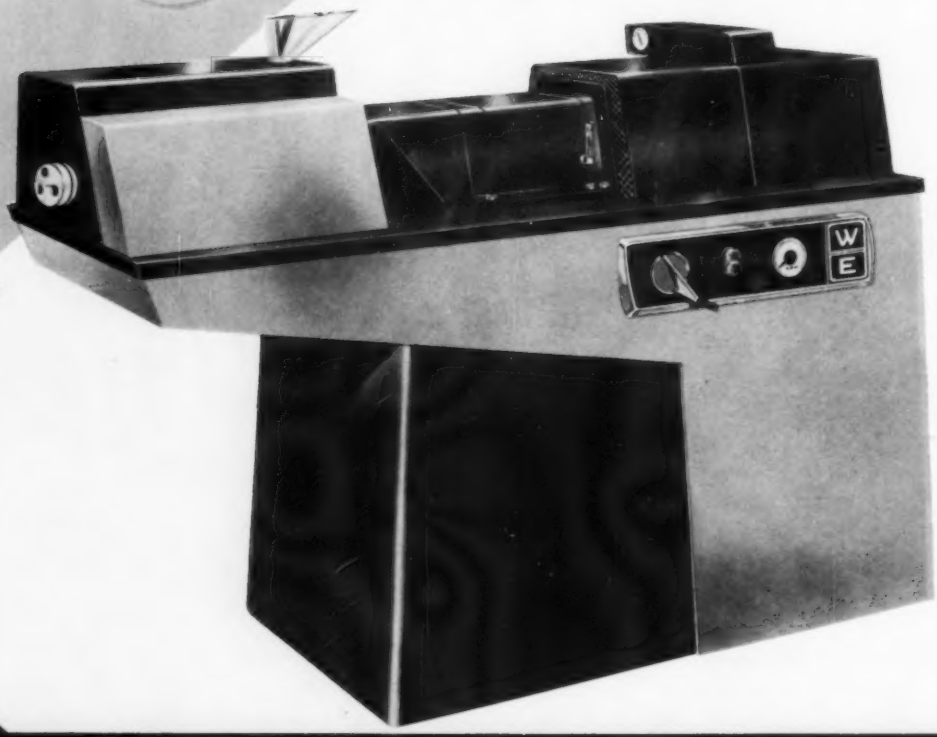

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R. E. WILEY*

A micro-flow melt indexer— how to build it

Most accurate or not, melt index is the standard method of measuring thermoplastic flow. The standard indexer is both unwieldy at the processor level, and requires larger amounts of material for testing. This article tells how to build a miniature unit which requires only very small samples to give reproducible results in a minumum amount of time.—Editor.

Melt index is the most widely measured flow parameter in thermoplastics. While many agree (in light of modern theory of viscoelastic flow) that melt indexing of resins is an inadequate way to characterize such flow,[#] the melt index approach has become deeply rooted and highly standardized.

Melt index of polyethylene is defined as the extrusion rate in grams per 10 minutes from a standard piston-cylinder-orifice assembly, under a 2,160 gram dead-weight load at 190± 0.2°C. Other standard temperatures as well as a variety of standard loads have been set up for different resins and different flow ranges. The miniature instrument in this article was developed primarily for polyethylene, and was intended to reproduce on a smaller scale the conditions in the standard melt indexer.

A complete description of the standard indexer, recommended melt indexing procedures, and a detailed list of temperature and load conditions may be found in "Tentative Method of Test for Measuring Flow Rates of Thermoplastics by Extrusion Plastometer," ASTM Designation: D 1238-57T, published by the American Society for Testing Materials.

In development and technical service work, many situations arise where the amount of sample material available is insufficient for a standard melt index determination. Often, only a gram or two of film can be subjected to extensive investigation. Since density (the other prime factor in classifying polyethylene) may be conveniently determined by density gradient techniques on extremely small samples, a semi-micro method of melt indexing seemed highly desirable.

There was also dissatisfaction with the heating and temperature control system generally used in the standard indexer. The time required for charging the cylinder, allowing the sample to reach operating temperature, and cleaning after each determination needed reduction.

The maintenance problem on melt indexing equipment—particularly cylinder insulation, electrical heating elements, and temperature transducers—influenced the design of miniature equipment. Components are standard, easily replaceable items, arranged in such a fashion as to be least subject to wear or damage.

The primary consideration in a scale-down procedure was preservation, insofar as possible, of the rheological constants in melt indexing. The apparent shear stress, in particular, was held close to that existing in the standard indexer (approximately 2.8 psi, or 2 x 10^5 dynes/cm^2). The length-to-diameter ratio of the die, and the diameter ratio of die and barrel were kept the same.

This assured that measurements of resin flow would be made at substantially the same point on the shear stress/shear rate curve as in the conventional technique. This, it was thought, should provide the simplest and most logical correlation between instruments and facilitate calibration of the new device.

Indexer construction

The actual scale-down was by a volume factor of 8 to

* Research Chemist, Special Developments Group, Polymer Service Laboratories, U.S. Industrial Chemicals Co., Tuscola, Illinois.

E. H. Merz and R. E. Colwell, "A High Shear Rate Capillary Rheometer for Polymer Melts," ASTM Bulletin, September, 1958.

Fig. 1. Miniature, micro-flow melt indexer.

10, a linear decrease of approximately 2. The orifice, for example, was reduced from 0.082-inch diameter to 0.040-inch. Since the piston and barrel diameters were reduced in like fashion, the load was cut by a factor of about 4 to maintain similar pressure and therefore, shear stress.

A sample size of ⅛ to ⅒ standard should then suffice for a melt index determination, and the weight of resin extruded during measured time intervals will be ⅛ to ⅒ that encountered in the conventional procedure.

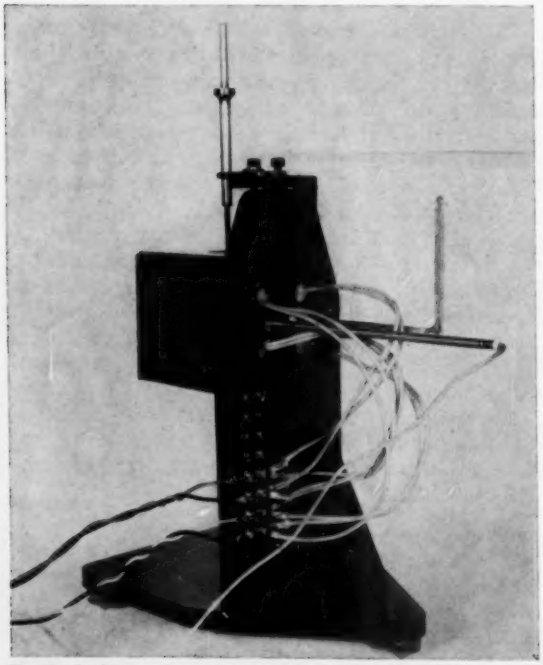

Fig. 2. Back view shows electrical connections, thermometer, and thermistor probe as well as the four pair of leads from the block cartridge-heaters.

The controlled temperature system was designed with the highest heat capacity practical for its size, the heat to be supplied by small cartridge heaters. It was strongly felt that an instrument of this type should have enough heat capacity to resist upset when a sample is charged. This simplifies the temperature control problem, since the controller merely maintains a steady-state condition. A thermistor-type temperature transducer is the only really practical means of actuating a controller. High sensitivity, rugged construction, and fast response make the thermistor probe much to be preferred over the mercury-in-glass thermoswitch. Several users of standard melt indexers have already made this substitution.

The heart of the new indexer is a 2 x 2 x 2½-inch aluminum block with appropriate holes accommodating all attachments. Six ⅜-inch diameter holes handle four 50-watt cartridge heaters, the thermistor probe, and a standard thermometer. The latter two items are inserted in aluminum sleeves to assist heat transfer and to speed response time. All free hole space toward the front of the block is filled with ⅜-inch diameter aluminum plugs of appropriate length.

The block is mounted to a ¼-inch phenolic plate which, in turn, is bolted to the vertical frame of the indexer. This frame is provided with openings corresponding to the holes in the block. Heating elements, thermometers, etc., may thus be removed and inserted from the rear, and are normally held in place by glass wool.

The hardened steel indexer barrel is fitted tightly in a longitudinal hole and held at both ends by bronze retainers. As in the standard indexer, the small orifice is inserted and removed from the top of the barrel, and is held in place by the lower barrel retainer.

The front and sides of the block are insulated with ½-inch asbestos board, held by 16-gage stainless steel covers. Top and bottom are covered with phenolic plates. Asbestos board is also used between the block and its rear mounting plate.

Two heating elements in opposite corners of the block are directly connected to an adjustable voltage source, while the other two (in the other corners) are connected to another adjustable source through the controller relay. The excellent heat conductivity of this assembly eliminates any detectable non-uniformity of temperature, once equilibrium has been reached.

Temperature control is accomplished by a relay in half of the heater circuits as already mentioned. This relay operates on unbalance of a conventional a-c bridge of which the thermistor probe forms one arm. The bridge is easily adjustable to ± 0.05° C., and the controller will hold the system within ± 0.1° C., as indicated by the standard indexer thermometer.

The voltage regulating autotransformers are set very much the same as with the standard instrument, except that settings are much less critical. The problem of voltage adjustment in the controlled heater circuit to provide a combination of minumum steady-state cycling and maximum recovery rate is essentially eliminated. The high heat capacity of the block, combined with small sample size, causes no observable temperature

change when a sample is charged.

The plunger is constructed in two sections; the piston proper (of hardened steel), and a sleeve. This facilitates handling and decreases heat losses by conduction through the plunger. The sleeve is provided with a machined and polished shank which makes a close fit with a bronze guide ring mounted on the frame. The plunger system is thus assured of a vertical orientation at all times. The guide swings out of the way to provide free access to the cylinder for cleaning.

A set of accessories is provided, much the same as with the standard instrument. A bronze push-out tool for removal and replacement of orifice; a stainless steel plunger for charging; a mounted drill for cleaning the orifice; and a mild steel tool for use with .22 caliber rifle patches in cleaning the cylinder.

Operating procedure

Operation of the miniature melt indexer follows quite closely the technique used with the larger model. After temperature equilibrium is obtained at 190° ± 0.2° C., the charge (approximately 500 milligrams) is placed in the cylinder, pushed down firmly with the charging tool, and the plunger assembly placed in position.

After one minute, the weight may be added and extrusion begun. Appropriate, precisely-measured time intervals are selected to produce extrudate weights of 20—40 milligrams. Several of these extrudates are then collected, weighed to ± 0.1 mg., and the result converted to grams/10 minutes. This quantity is directly related to melt flow index, as will be seen in the discussion to follow.

The scale-down of approximately 8 to 1 was expected to yield flow results directly to melt index by a factor of about 8. It was also expected that this relationship would be linear if the shear stress level were preserved.

Accordingly, a series of eighteen conventional polyethylenes with melt indexes in a range of 1 to 10 were were tested on both the new instrument and on a standard indexer. The result is shown in Figure 5. The relationship was linear as it passed through the orifice, and the conversion factor was 6.51. This figure may be used to obtain melt index from miniature indexer data. Actually, the deviations of individual values from the straight line are negligible when compared with the probable error inherent in melt flow measurements of this type.

The plunger load used in these measurements was 2,160 grams in the standard indexer, upon which the definition of polyethylene melt index is based. A smaller load was applied to the small indexer to maintain identical shear stress level.

Polyethylene of melt index 10—100 is generally tested under a lighter load, 325 grams; and an empirical log-log relationship is used to convert flow to "equivalent" melt index. In order to extend the utility of the new device, five polyethylenes of 10—100 melt index were tested, using a 325-gram load in the standard instrument and the corresponding lighter load on the miniature indexer.

As seen in Figure 6, a very good linear relationship was again obtained. Futhermore, in somewhat phenomenal fashion, the line showed precisely the same slope as in Figure 5, yielding the identical 6.51 conversion factor. Theoretically, of course, these slopes should be the same; but such close agreement was surprising and gratifying.

Fig. 3. Front view with top and front insulation removed.

Such linearity and agreement using different loads suggested the simple procedure of calibrating the miniature instrument against a standard indexer, using an 8 melt index resin under standard load. Depending on the exact dimensions of each miniature indexer orifice, some conversion factor (probably between 6 and 7) would be obtained for use with the specific orifice. Hence, exceedingly close tolerances on such a small orifice would be unnecessary.

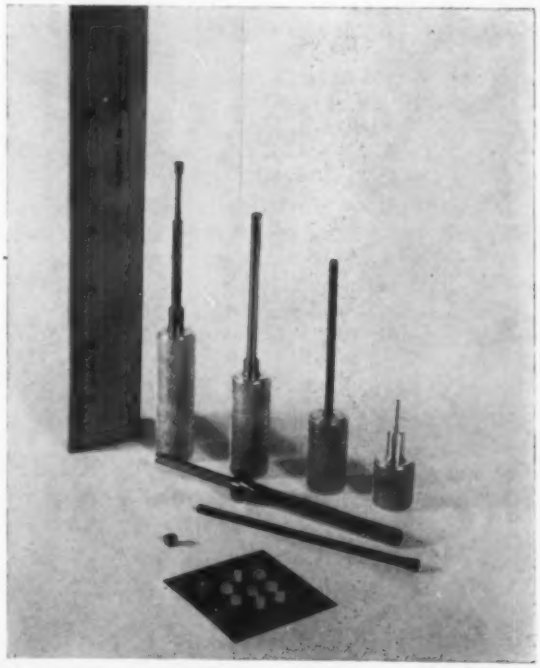

Fig. 4. Indexer accessories; note comparative size of polyethylene test cubes.

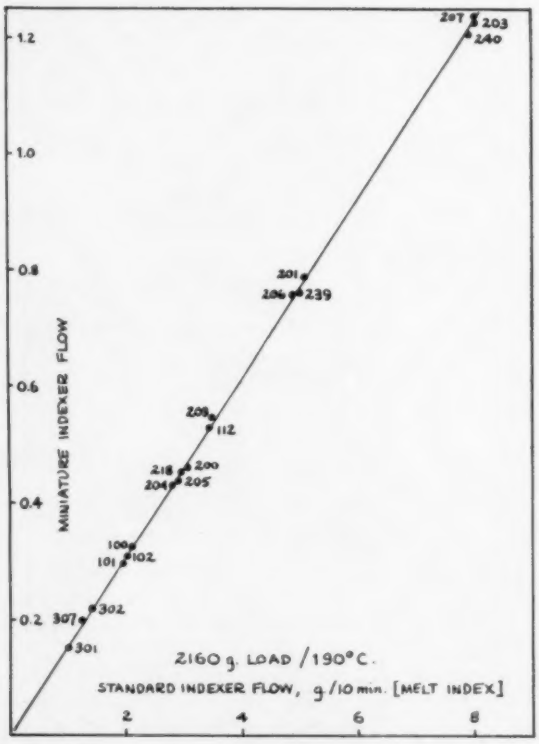

Fig. 5. Melt flow comparison of polyethylenes under a 2,160 gram load. Numbers indicate Petrothene grades.

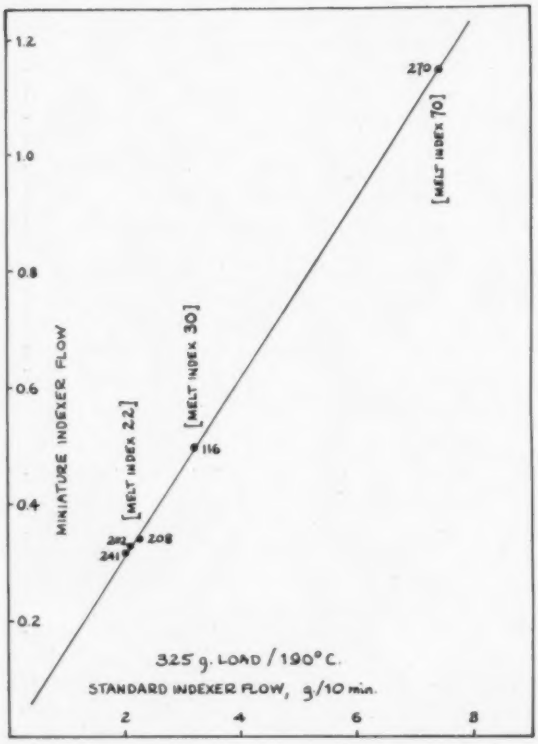

Fig. 6. Melt flow comparison of polyethylenes under 325 gram load. Numbers indicate Petrothene grades.

Conclusion

The miniature indexer has found much practical use in the development laboratory, where a melt flow index is often desired on samples of less than one gram. Actually, reproducible results have been obtained on amounts as small as 200 milligrams. It has been used in checking uniformity of blends, by testing of 500 mg. samples from different parts of a milled sheet.

Application to routine analysis may be of significance, since the device appears to give results as reproducible as the standard instrument, and requires less operator time per sample. Specifically, 8—10 determinations of melt index can be run in an hour on the miniature instrument, as compared to 4—6 with the standard indexer. A slightly more delicate technique is required, however, and the drastic reduction in charge size might raise problems of correct production sampling.

We feel that the construction features of this instrument should be taken seriously into consideration as possible avenues of redesign for the standard indexer. Among these, the use of a high heat capacity system for temperature stability, standard cartridge heaters for rapid replacement, relocation of thermometer and thermoregulator out of harm's way, and use of a plunger guide seem to offer the greatest immediate utility.

Acknowledgment

The author wishes to express appreciation to his colleagues at the Polymer Service Laboratories who have assisted in evaluation of this instrument, and to management for their interest and support. —THE END

"Markets for Flexible Foams" by P. B. Nortman

So many of you have written in for copies of this article that we decided to reprint it as a booklet. For those who may have missed it, the article surveyed markets for polyurethane, vinyl, and latex foams by fields—auto, furniture, etc. Special emphasis is placed on the urethanes.

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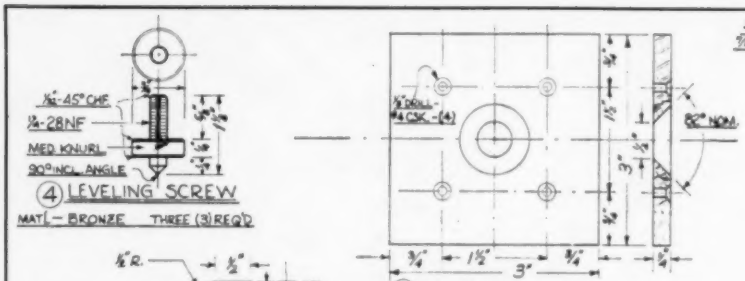
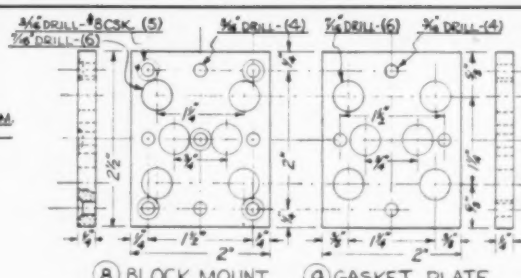


4 LEVELING SCREW

MAT'L – BRONZE THREE (3) REQ'D

7 COVER INSULATOR

MAT'L - "MICARTA" ⅛" TWO (2) REQ'D



8 BLOCK MOUNT

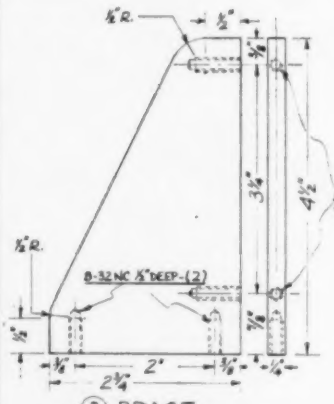
MAT'L - MICARTA ¼"

ONE (1) REQ'D

9 GASKET PLATE

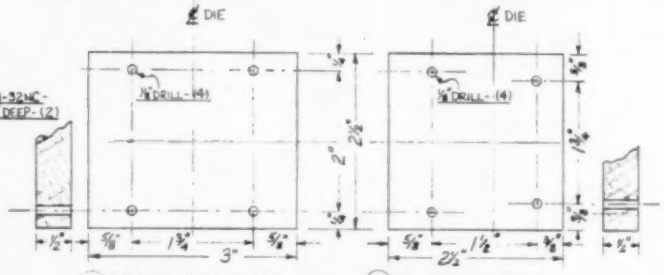
MAT'L - ASBESTOS BOARD

ONE (1) REQ'D



3 BRACE

MAT'L - C.R.S. ONE (1) REQ'D

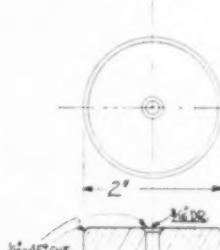


5 FRONT INSULATOR

MAT'L - ASBESTOS BOARD ONE (1) REQ'D

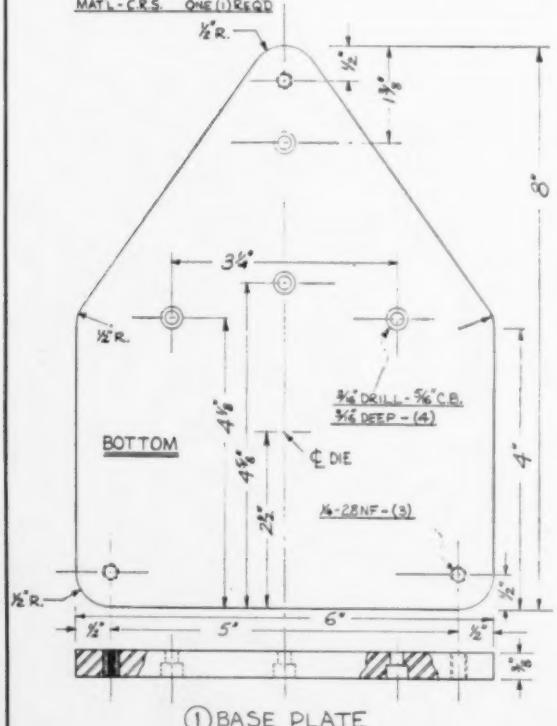
6 SIDE INSULATOR

MAT'L - ASBESTOS BOARD TWO (2) REQ'D



20 LARGE WEIGH

MAT'L - SOFT BRASS ONE

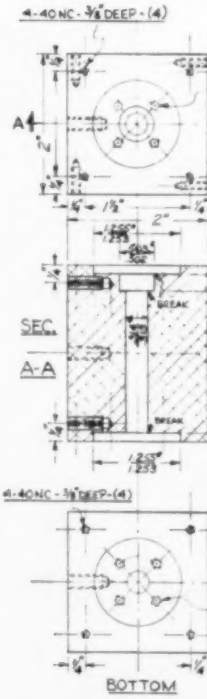


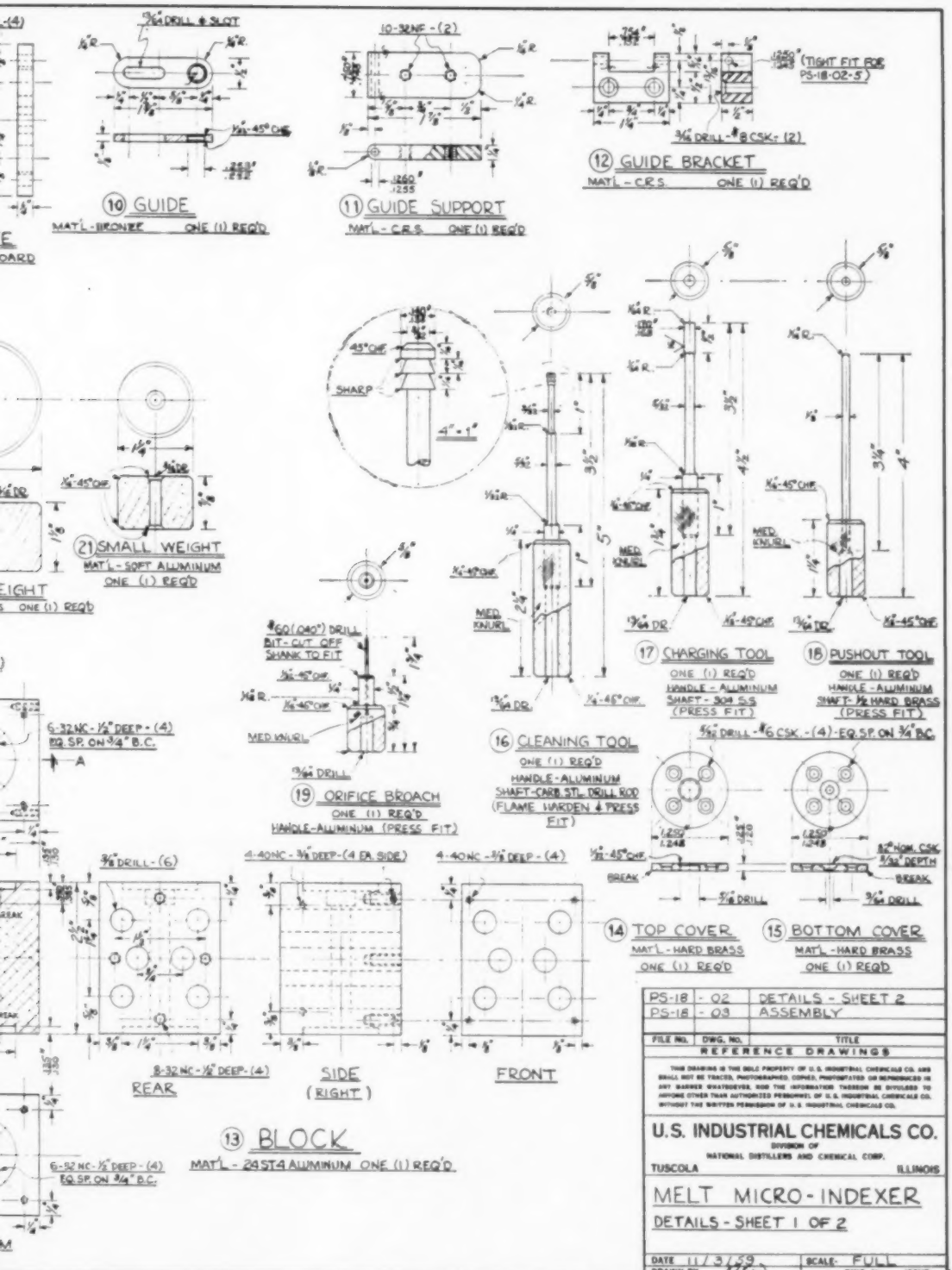
1 BASE PLATE

MAT'L - C.R.S. ONE (1) REQ'D

2 UPRIGHT

MAT'L - C.R.S. ONE (1) REQ'D





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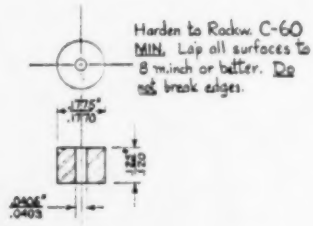

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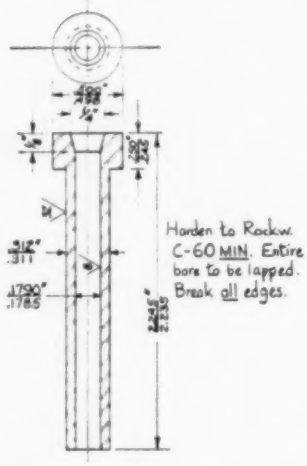
MAT'L - SAE 4340 STL.
ONE (1) REQ'D

SCALE 48" = 1'-0"



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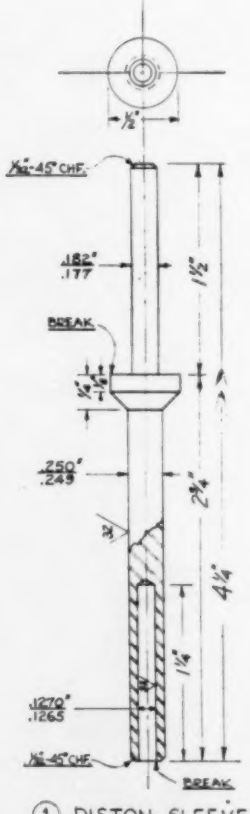

① PISTON SLEEVE

MAT'L - 304 S.S. ONE (1) REQ'D

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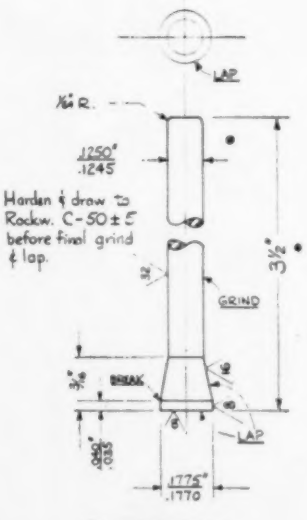
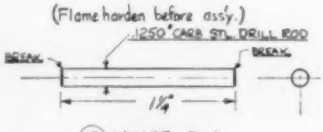


② PISTON

MAT'L - HI-SPEED DRILL ROD
ONE (1) REQ'D

SCALE 48" = 1'-0"



⑤ HINGE PIN

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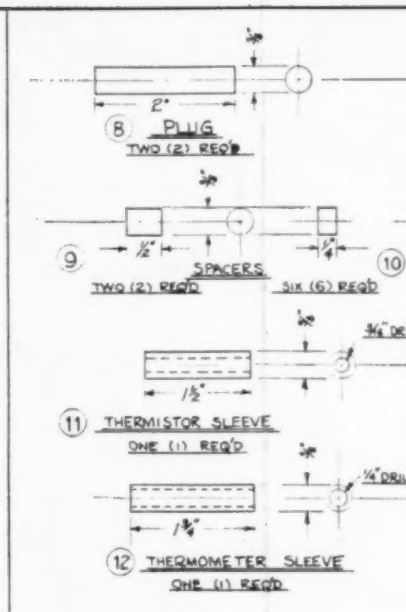
SCALE 24" = 1'-0"



MAT'L - ALUMINUM

SCALE

⑥ SIDE

TWO (2

(10)

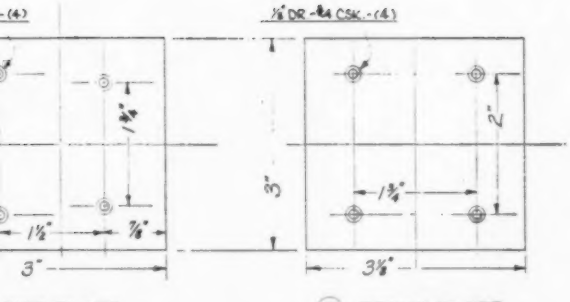
5/16" DRILL

1/4" DRILL

SCALE - FULL

-(4)

1/8 DR - #4 CSK. - (4)



SIDE PLATE

MATERIAL - #16 GA. S.S. SHEET

SCALE - FULL

WO (2) REQ'D

7 FRONT PLATE

ONE (1) REQ'D

PS-18	- 01	DETAILS - SHEET 1
PS-18	- 03	ASSEMBLY
FILE NO.	DWG. NO.	TITLE

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DETAILS - SHEET 2 OF 2

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Single-screw injection molding

J. G. Fuller

Dr. H. Frimberger

DR. H. FRIMBERGER*
J. G. FULLER*

The various principles of injection molding are discussed, with emphasis on the single-screw machine. This Ankerwerk unit has attracted considerable interest, and almost unquestionably offers advantages in the molding of vinyls and certain of the more difficult materials. The controversy, if it can be called that, is whether it is as economical as American units in the long-run molding of general purpose materials. One important factor to remember is that runs may be very long, but seldom are they uninterrupted. Basically, you have a choice of three types of injection machines: straight injection, ram with "piggy-back" preplasticizer, and reciprocating single-screw unit. Whatever your choice, know your reasons.—Editor.

The European trend toward plastic injection machines with a single screw plasticizer (90% of all injection machines now being produced are of the single screw type) has led to considerable discussion in the United States regarding this system and principle. Both American and European manufacturers are offering such equipment for sale in this country with good acceptance. Now is a good time to review, briefly, the history of these machines and to explain in some detail the reasons for their effectiveness. Such a study will help injection molders to evaluate this new system and its advantages or disadvantages for their own particular needs.

When the first machines for injection of plastics were built, they consisted essentially of a heated cylinder in which the material was melted mechanically (Fig. 1a). It was soon found that such a system did not work too well, at least in regard to plasticizing capacity, which is a measure of the amount of heat transferred into the material in a given time. The reason for this shortcoming can easily be seen by studying the formula for the conduction of heat which is governed by Fourier's Law:

$$Q_{th} \overset{\lambda}{=} -(D_1\text{-}D_2)\ F$$

When this law is applied to an injection machine, thermal conductivity (λ) can be ignored since all plastics have very poor thermal conductivity. The difference in heat (D_1-D_2) cannot be increased to a very high level, or the material touching the hot cylinder wall will be completely decomposed. This complicated formula can, therefore, be reduced to a simple expression which says that the amount of heat flowing into the melt in a unit of time is proportional to the active surface area, and inversely proportional to the thickness of the melt layer.

The need for faster plasticizing led to larger cylinders with greater surfaces and, also, to the use of spreaders (torpedos). These reduced the thickness of material layers and also added to the surface area. Such a machine is shown in Fig. 1b. Torpedos increased the plasticizing speed, but left other problems. Enlarging the plasticizing

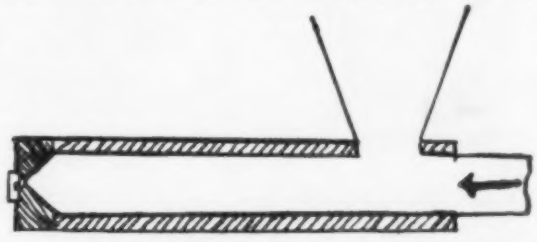

Fig. 1a. Earliest injection machine with heated cylinder and manual or mechanical plunger.

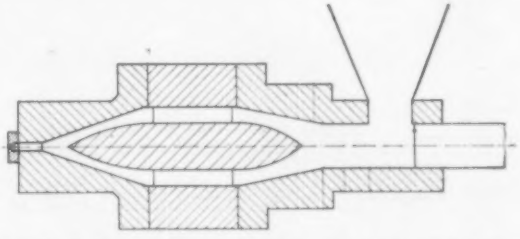

Fig. 1b. Basic injection machine with spreader (torpedo).

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** Sales Mgr., Ankerwerk and Krauss-Maffei

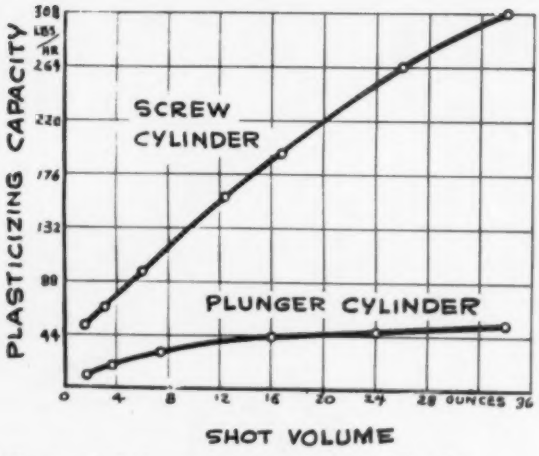

Fig. 1c. Plasticizing capacity for polymethylmethacrylate.

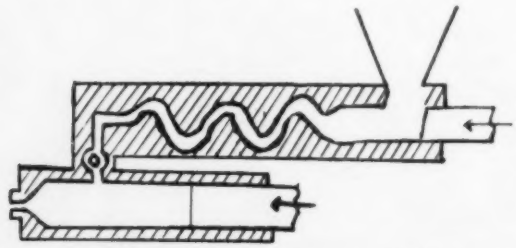

Fig. 2a. Injection unit with long, heated channel for plastification.

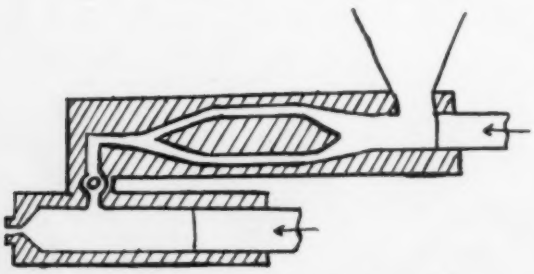

Fig. 2b. Injection unit with standard torpedo plastification.

Fig. 2c. Injection unit with accumulator in front of the plasticizing system.

cylinder causes the accumulation of heated material, thus making it more difficult to change colors or materials. The use of longer or thinner bores (channels) in the spreader system further restricts material flow, and requires higher pressures to force the material through.

These problems increase with shot weight. For certain throughputs within given times, the spreader bores must be larger in cross section to eliminate excessively high injection pressures. This, in turn, cuts heating efficiency and reduces effective plasticizing capacity per hour for torpedo cylinders in the larger shot-capacity ranges. Fig. 1c shows this effect in acrylics. The points on the line indicate the plasticizing amounts obtained with five different-size torpedo cylinders formerly produced by Ankerwerk. Additional plasticizing units were added to the machine as preplasticizers—all of which overcame the limitations to a certain extent. Three major designs of this line of machines are shown in Fig. 2.

Type 2a uses a long, heated channel. Material is pushed through by the upper piston; then accumulated in the lower cylinder from which it is injected. This type has not been very successful because of the high restriction in the long bore, the difficulties of controlling the temperature, and the prolonged time during which material particles are exposed to heat. Too, it was nearly impossible to change color or material within a reasonable time.

Type 2b uses a standard spreader for plastification, after which the material is accumulated in the lower cylinder and injected from there as in Type 2a. Type 2c uses a standard spreader, but the material is first accumulated in front of the plasticizing system and injected by axial displacement of the whole plasticizing unit. This system might be called preplasticizing in line, in contrast to the first two systems which could be called two-stage plasticizing. Figs. 3 and 4 illustrate two such torpedo plasticizers. Although these preplasticizers perform better than the conventional torpedo machines, they have the basic limitations of poor heat transfer and laminar flow. They also require valves; material can enter the clearance between barrel and plunger; and you can get dead spots.

At this point, machinery builders considered the high plasticizing activity of a screw—known to be highly effective in extruders—as a plasticizing method for injection molding. The first step was to use an extruder for simply extruding material into a mold (Fig. 5a). Such a machine offers only a relatively low injection speed and pressure, suitable for the easily processed materials such as polyethylenes and very soft vinyls. Some machines using this principle have been introduced on the market.

These limitations suggested its use as a preplasticizer for extruding into a transfer cylinder, then injecting the accumulated material (See Fig. 5b). Several machines have been built on this principle, some with twin screws.

Referring to Fig. 2b, there is great similarity both in system and results. The spreader has been eliminated, but still remaining are the difficulties described before as mechanical problems—dead spots, valving, and material entering the clearance between barrel and plunger. One very definite plus point of this system is its easy

adaptability to existing, conventional machines—with resultant increase in their capability.

Modifications of this machine type have minimized these undesirable features, but not avoided them completely. The Jackson Church process (Fig. 6) uses a screw for preplasticizing, but before each shot, a measured amount of pellets are introduced by the upper piston. They cover the melt and seal it off from the clearance between plunger and barrel. This machine permitted, for the first time, the running of sensitive materials such as unplasticized PVC under real production conditions. At least one difficulty remained with this machine—the non-homogeneous melting of pellets.

Ideally, a machine should be a screw plasticizer which would accumulate the melt but not be a preplasticizer. Several companies thought of using an extruder with an axial displacement, accumulating melted material with subsequent injection by pushing the screw itself. In some countries, patents were filed describing such machines (Fig. 7) over 15 years ago, but no manufacturer went into production. A screw with its relatively deep flights could not seal much injection pressure and, instead of being injected into the mold, the material would flow backwards along the screw.

Fig. 8a gives a simplified picture of the existing pressure relation in an extruder. The screw extrusion pressure works against the restriction of the die. If the pressure to overcome this restriction is higher than the extrusion pressure, no material will be extruded; all will be lost by back-flow. If a screw is used as an injection piston, and the injection pressure is higher than the extrusion pressure (as it would be in most cases), then the material actually flows backwards along the screw during injection instead of entering the mold.

The theoretical advantages of such a machine were so obvious, however, that further work was done. One way to prevent back-flow is to use an interlocking twin screw extruder. The flights are sealed against back-flow and only very small leakages occur along the clearance between the screw and the cylinder wall. Machines of that type were built by the Windsor Co., and were capable of handling large shot capacities—even with relatively difficult materials (See Fig. 8).

Any twin screw machine, however, has two basic limitations: limited space for thrust bearings and the different shape of the two head screws (as compared to a one-cylinder head). This means limitations in injection pressure and a certain "hang-back" of material in the head. Logically, these machines could not handle extremely sensitive materials, and color change was not very favorable. The Windsor Co. then tried using a reciprocating single screw. Fig. 9 shows a patent granted to this company.

To avoid back-flow, the screw plasticized only in a fixed position, allowing material to pass to the front by going through an annular groove in the cylinder. During injection, the screw tip passed out of the annular groove and acted as a piston with close clearance to the cylinder wall. After injection and holding pressure time, the screw was retracted hydraulically to the plasticizing position for working the next shot. But this retraction created a vacuum in front of the screw, causing air to be sucked into the chamber with subsequent degradation of material and difficulty in normal injection. This

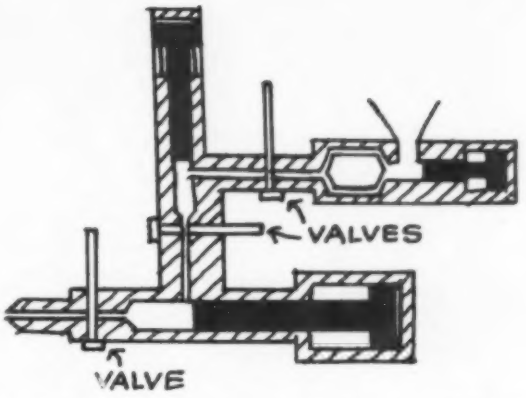

Fig. 3. Typical injection machine with torpedo preplasticizer.

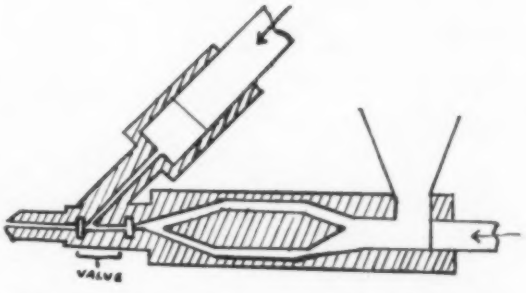

Fig. 4. Typical injection unit with torpedo preplasticizer.

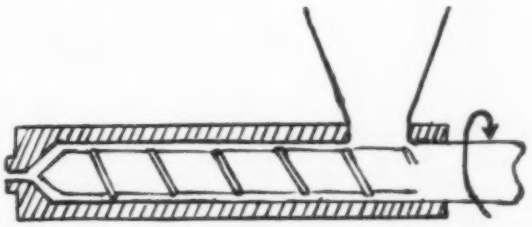

Fig. 5a. Extruder used to extrude material directly into a mold.

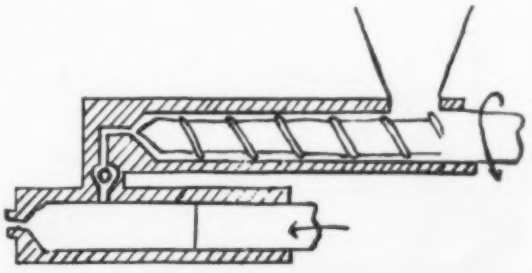

Fig. 5b. Preplasticizing extruder extrudes into a transfer cylinder which injects into a mold.

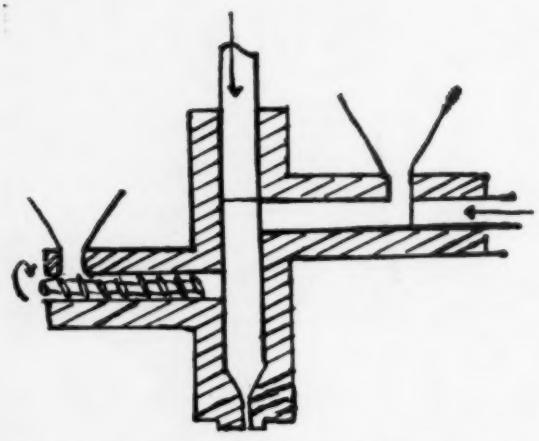

Fig. 6. Screw preplasticization, with measured amounts of pellets introduced by upper piston (Jackson Church process).

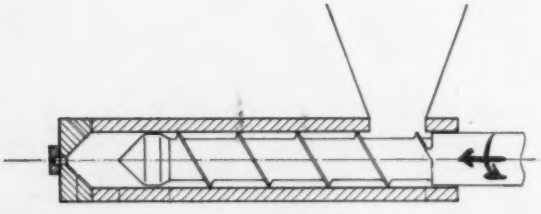

Fig. 7. Screw plasticizing with axial displacement for material accumulation.

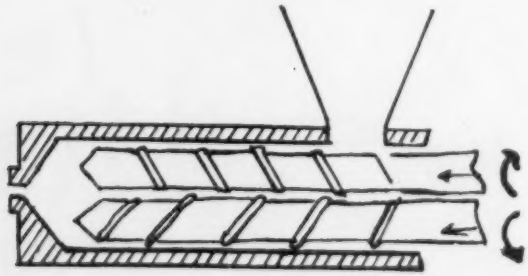

Fig. 8. Twin-screw plasticizing with flights sealed against back-flow.

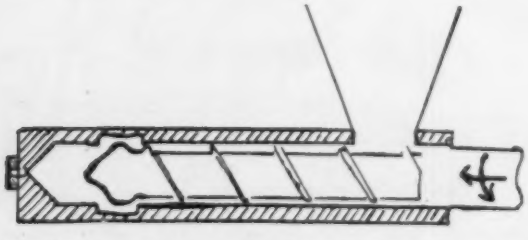

Fig. 9. Reciprocating screw plasticizing.

was approximately the state of development five years ago when Ankerwerk decided to build an in-line, single screw machine.

The foremost question encountered was: "How could we solve the problem of back-flow along the screw during the injection stroke?" The answer was very surprising. There was no problem! Friction at the rear of the cylinder causes pellets to compress and melt, forming a plastic packing which seals against the injection pressure. Its effect can be many times higher than the extrusion pressure. In fact, this plastic packing can seal any needed injection pressure except in the case of very fluid or very slippery materials. With such materials, the problem has been solved by the use of non-return (check) valves fixed to the screw tip. Fig. 10 shows the principle, action, and simplicity of such a device.

A short trial period with a prototype machine proved the effectiveness of this type system. Screw plasticizing not only improves injection molding results, but also increases the number of new type applications. A complete understanding of the potentials involved would come from a study of the basic functions of the machine and, in particular, the details as to how the melt is produced, controlled, and finally injected by a reciprocating screw mechanism.

We shall first outline the complete cycle in broad terms, using Fig. 11, and then break down the various sections of the cycle to show their bearing on the two most important considerations in producing a well molded part:

1.—The proper melting and homogenizing of a thermoplastic material without altering its basic physical, chemical, and molecular characteristics.

2.—The proper controlling of injection to eliminate any further tendency towards degradation and to allow the melt to reform with the best possible combination of properties to produce a strong, well molded part. Both considerations are governed as much or more by the basic design and quality of the processing machine as by the characteristics and quality of the plastic raw material.

Plasticizing

Plasticizing of a thermoplastic compound takes place by the addition of heat. Using a screw machine, we have two ways to introduce this heat: from external cylinder heater bands or from frictional heat derived from shearing inside the compound during screw rotation.

The external heater bands afford thermal control and insulation much the same as they do in extrusion. This is true even though the operation of the screw is discontinuous. The shearing forces, which provide a major source of frictional heat, are caused by the peculiar flow characteristics of material within each screw flight as a result of the screw's feeding action. Fig. 12 may make this process understandable.

In each screw flight, we have at least two main flow directions. As the screw rotates, the forward surface of the flight at F is thrusting melted material forward with great force against the surface of the cylinder creating flow Q_1. At the same time, the rear surface of the flight at R falls away from the melt-creating, in effect, a rearward movement of the melt Q_2 in relation to the for-

ward thrust of Q_1. A small part of the material thrust forward by Q_1 is conveyed along the helix of the screw at each revolution, but most of the Q_1 forward thrust goes toward filling the void created by the falling away of flight surface R from the melt. In this manner, the transverse flow pattern Q_3 is created within each flight at every point along the screw. This rigorous mixing prevents any particles from remaining stationary, thus making the plastic mass mechanically and thermally homogeneous.

A cross-sectional picture of the plastic mass contained within one screw flight (Fig. 13) during a color change from dark to white shows the high mixing action of the transverse flow as manifested by the swirling pattern of colors. Because this process takes place at every point along the screw, and no one particle remains adjacent to another for any period of time, the insulating effect of plastic layers is eliminated.

The shearing forces melting the material are easily controlled by varying screw speed and the hydraulic pressure maintained against the rotating screw during plasticizing. Plasticized material is metered out in front of the screw. This presses the screw backwards against a controlled pressure until the precise amount of melt is accumulated for the next shot.

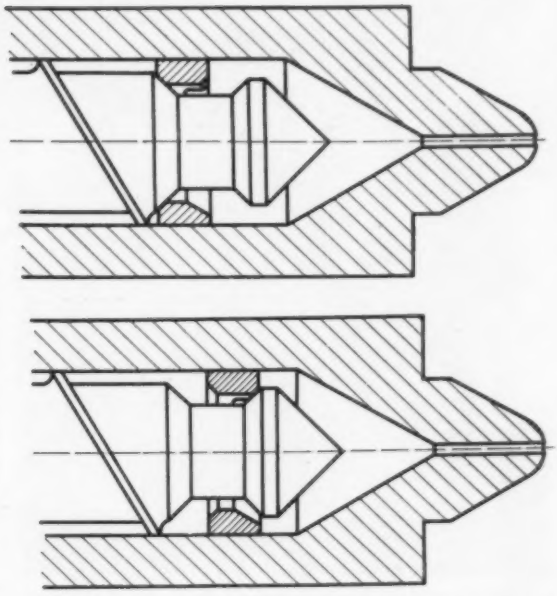

Fig. 10. Single screw plasticizing with non-return (backflow) valves fixed to the screw tip.

Melt Quality

The term "melt quality" is a rather complex one, and we would like to discuss some of the factors considered most important for a high melt quality.

PURITY OF MELT. The conventional ram cylinder and most preplasticizers are characterized by dead spots in their designs—areas where material can hang back and decompose. In preplasticizers where ram pressure is applied directly on melted material, some material is always forced into the space between the ram and the cylinder wall. Here, it gradually decomposes and sloughs off back into the melt. This causes contamination. In a reciprocating screw machine, the clearance between screw and cylinder wall can be controlled. It is also filled with material, but because of the screw action and leakage flow, it cannot remain on the land and become burned. Because of this feature, acrylic optical lenses of highest quality have been produced.

ABSOLUTE VALUE OF VISCOSITY. The lower the viscosity, the easier it is to fill the part and the better its physical characteristics and appearance. Less injection pressure is required to fill a particular part, and a greater ratio of flow lengths to wall thicknesses are obtained. Molecular orientation always takes place where there is laminar flow of material which is not at its optimum melt viscosity. We have such a laminar flow in the plasticizing cylinder of the conventional ram machines. In a screw machine, this laminar flow inside the plasticizing cylinder is very small as the mixing action of the screw eliminates any tendency toward stratification. Laminar flow produced by filling the mold from one gate can hardly be influenced by any type of machine, since this method of mold filling is fundamental to the injection process.

The amount of orientation produced by this laminar flow into the mold, however, is widely influenced by the viscosity of the melt injected. The higher the viscosity,

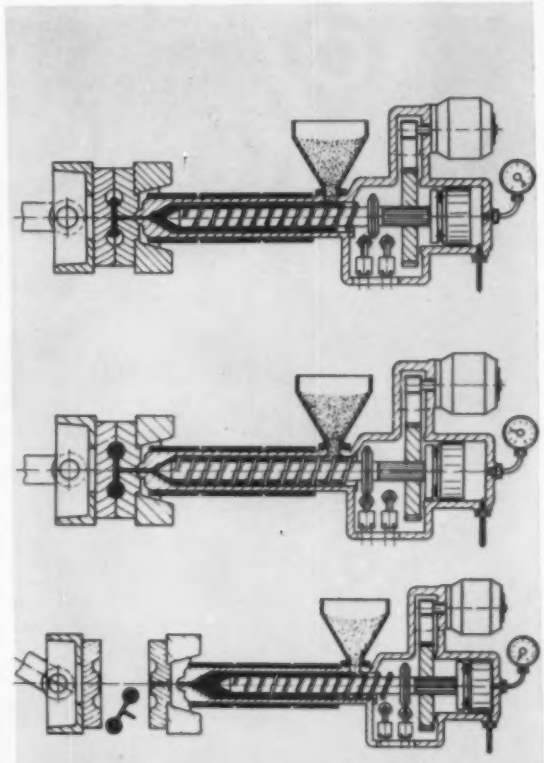

Fig. 11. Reciprocating screw plasticizing cycle: Top—mold filling period by axial displacement of screw under high pressure; Middle—end of mold filling and beginning of plasticizing cycle by screw rotation; and Bottom—end of plasticizing cycle with screw stopped by limit switch and molded part ejected.

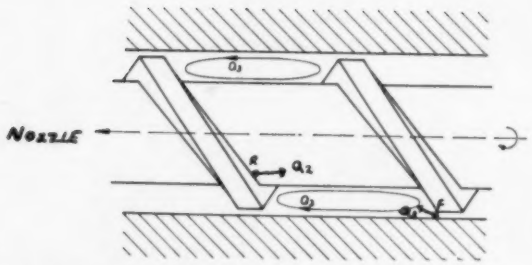

Fig. 12. Shearing forces provide frictional heat.

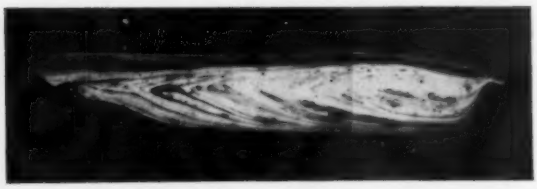

Fig. 13. Transverse flow in the screw flights.

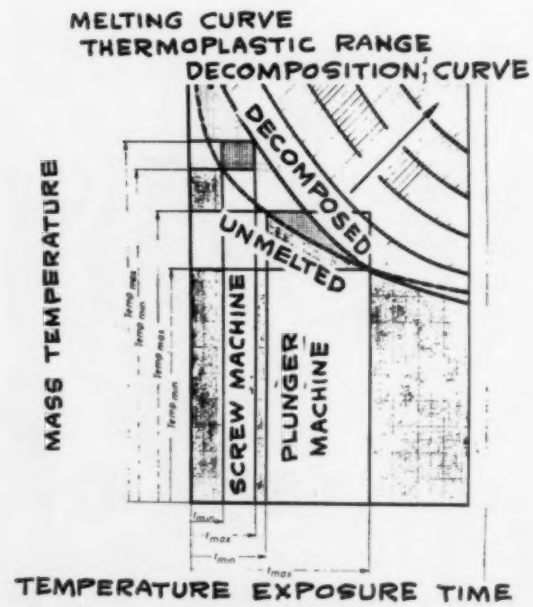

Fig. 14. Thermo-tolerance as a function of temperature and time.

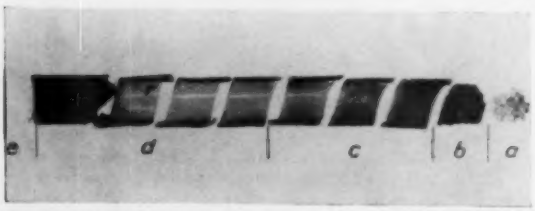

Fig. 15. Various stages of PVC in screw cylinder: a) cold granulate, b) compression of solid granulate, c) transition to plastic state, d) thermal homogenization, and e) head and nozzle zone—no material change.

the higher the drag forces forming this lamination and the higher the orientation within the mold. The best parts will, therefore, be produced by the machine which allows a heating intense enough to obtain the lowest melt viscosity without decomposition.

Molecular orientation is reflected in the physical property values taken in transverse and longitudinal directions. Parts made with screw machines show much less differential between these two values than are normally experienced with ram machines.

THERMO-HOMOGENEITY. The safe temperature range of the plastic state for different thermoplastics usually is narrow. Proper molding must be done inside this narrow range. With conventional ram machines, it is necessary to use the highest limits of the molding range (just before chemical degradation) to obtain the lowest viscosity.

The critical range of plastic behavior does not depend on temperature alone, but also on the time the material is kept at a certain temperature. This leads us to a discussion of the thermo-tolerance of a material as a function of temperature and time. Fig. 14 shows this phenomenon in diagrammatic form. The range of the thermoplastic state for a given material is defined by plotting the thermo-heating time as abscissa, and the mass temperature as the ordinate. Below this line, the mass is not yet in the thermoplastic state; it is only thermo-elastic. This means it tends to return to its former shape, and orientation during injection would be very high.

The dotted line shows the curve where the thermoplastic starts to melt. The heavy line shows the time-temperature relationship. Beyond this, the material starts to degrade. The minimum and maximum heating times possible in a plunger machine are marked on the abscissa. The temperature ranges which can be maintained on screw and plunger machines are marked on the ordinate.

We find, that with a screw machine, we can handle this material within its given safety range. Complete melting is obtained without thermo-degradation. The plunger machine gives a different picture. Here, we have approximately one-third of the material under good melting conditions. The other two-thirds are not yet plasticized, or are already decomposed. With such a mixture, no really good parts can be obtained.

Such close control of temperature and heating time in a screw machine makes it possible, for example, to process rigid vinyl continuously at 90° F. above the point where degradation is normally considered to begin. At such a high temperature, the viscosity of rigid vinyl is close to styrene. Resultant parts were of very high quality.

OPTIMUM RHEOLOGICAL CONDITIONS. The melt must pass through a narrow, high-temperature range with time being closely controlled. No mass particle must be allowed to dwell anywhere in the cylinder, or it becomes degraded. This requires that the screw and cylinder be properly constructed to ensure optimum flow. Fig. 15 shows the remarkably quick transition of compound from granular to melt state in the area of the screw flights. Good rheological conditions in a plasticizing system can be demonstrated easily by a color chang-

ing test, since a rapid and complete changeover would prove that old material is moving through the cylinder without leaving particles adhering to the walls or hanging in dead spots. Rapid color changeover has been demonstrated many times with the screw machine.

Fig. 16 shows a part injected during a color change on a plunger machine. Two differently colored materials enter the mold in laminar streams forming radial stripes. Fig. 17 shows clearly the difference in pattern with a screw machine. Where the two materials contact each other inside the plasticizing cylinder, there is a short zone of mixing. Due to screw rotation, this mixing is not laminar and, therefore, the stripes in the part are not radial but circumferential.

To demonstrate technological possibilities, photomicrographs of two polyamide parts are reproduced in Fig. 18. According to a test report of the Munich Technical High School, the part produced on the ram cylinder shows varying structures in cross-section. There are fine crystalline-amorphous layers mixed with haphazardly arranged spherulite-amorphous layers. The latter are shown in the left hand picture. In contrast, the right hand picture represents the structure of a molding taken from a screw cylinder. Notice that it is homogeneous and finely crystalline. Fig. 19 shows two partly-injected fittings in which the flow behavior of a non-homogeneous and a homogeneous melt can be seen (unplasticized vinyl).

Recently, exhaustive investigations have been made into the structure of rigid PVC moldings. These show that brittle or ductile behavior can be produced at will. Moldings produced with a screw cylinder at the surprisingly low pressure of 7,100 psi. had mechanical values in the range of 10,000 psi. Moldings produced with a ram cylinder had to be molded at a pressure of about 35,000 psi., in order to obtain mechanical values which were anywhere near that figure. There was also embrittlement, and the strength of moldings varied considerably.

Injection

Injection pressure

Viscous material can be molded only if considerable pressure is applied. The exact amount depends on the mass viscosity and shape of the molding, as well as the ratio of flow time to wall thickness. If the proper temperature of the melt is attained, the pressure required to fill the mold will be considerably reduced. A screw machine could be easily designed to use the same injection pressures as required by plunger machines. But, because of the ideal melt conditions and low melt viscosities obtained with a screw machine, there is no need for these high pressures. Parts molded at lower injection pressures have a far lower molded-in strain level.

At least 90% of the injection pressure applied to a screw machine on the injection stroke is transferred directly to melted material at the nozzle. If the starting pressure is 20,000 psi., this would mean a pressure of 18,000 psi. would be applied to the mold. If the part's projected area is only 20 square inches, the available pressure would open a 160-ton clamp machine which would be capable of molding much larger parts.

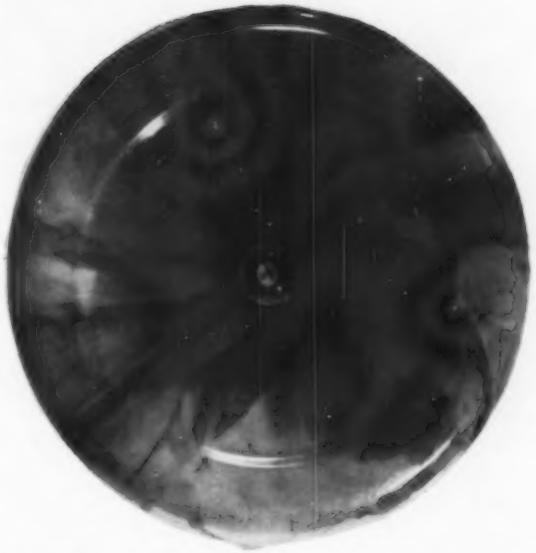

Fig. 16. Part injected during color change on a plunger machine. Note laminar flow.

Fig. 17. Parts injected during color change on a screw machine—crystal clear to white.

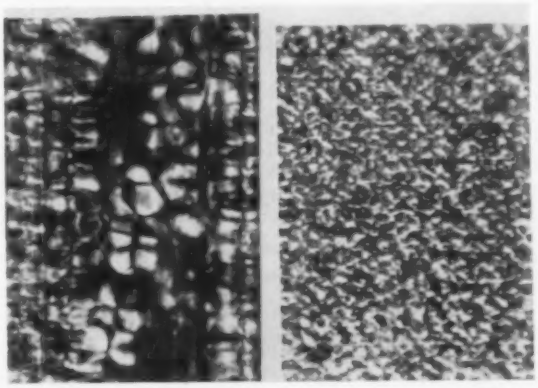

Fig. 18. Photomicrograph structure of nylon: left, ram cylinder; right, screw cylinder. (Magnification 560:1)

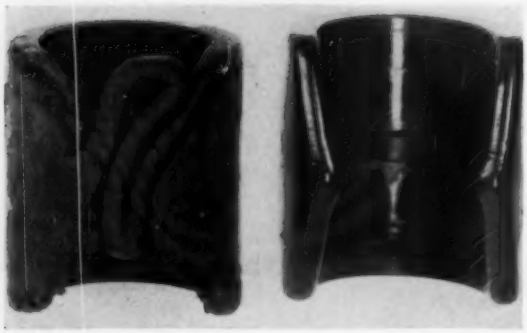

Fig. 19. Two partly-injected fittings. Note behavior of a non-homogeneous and a homogeneous melt (unplasticized vinyl).

MATERIAL	WEIGHT, Oz.	MACHINE, Type	PRESSURE, psi.	RATIO Flow-way/ Wall Thickness
PVC	30	V42-350	13,000	120:1
PVC, Unplasticized	2	V25-200	17,200	147:1
Soft Vinyl	½	V14-60	15,500	250:1
Polyethylene	12	V42-350	13,000	220:1
Polypropylene	¼	V10-30	12,000	285:1
Styrene	¼	V10-30	12,000	285:1
Styrene	½	V20-140	12,800	175:1
Polycarbonate	3	V20-140	12,800	76:1
Polycarbonate	50	V90-1000	10,600	88:1
Polyamid	¼	V15-75	9,600	127:1
Polyamid	7.5	V20-140	7,300	122:1
Cellulose Acetate	9	V25-200	12,100	122:1

Figure 20. Table of pressures and flow ratios. Single-screw injection molding

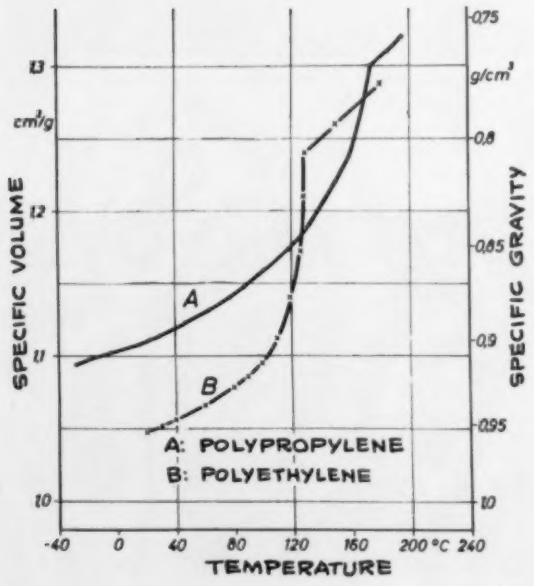

Fig. 21. Differences in specific gravity between polyethylene and polypropylene.

With a screw machine, therefore, high injection pressures are neither necessary nor desirable. Even very viscous melts such as polycarbonate, high molecular weight polyethylene, etc., could be injection molded on single screw machines with relatively thin walls and at pressures of 8,500-11,400 psi. Polyethylene with a molecular weight of 2,000,000 could be molded into thick-walled plates at a pressure of 8,500 psi. It was difficult to get this highly viscous plastic to flow, but it was not the pressure that made molding possible—rather, proper plasticizing of the material.

We have mentioned the ratio of flow time to wall thickness and would like to discuss this as an important means of assessing the relative ease of mold filling. How far away from the gate will material flow easily through a particular cross-section? Divide the distance from the gate by the cross-section. The higher this figure, the more difficult the part will be to inject. Low viscosity materials such as styrene or polyethylene can be molded at higher flow to thickness ratios than can such higher viscosity materials as acetates, polycarbonates, and vinyls.

Several plastic handbooks give the maximum ratios obtainable, using approximately 20,000 psi. injection pressure. These ratios for conventional ram machines are lower than 80:1. Fig. 20 shows a variety of ratios reached with different Ankerwerk and Krauss-Maffei machines under stated pressures. Because the ratios are governed by the part molded, these figures show no maximum, and vary with the different parts. They do show, however, that the screw machines could reach much higher ratios with much lower injection pressures than can the ram machines.

Holding pressure

Hot melt injected into a mold must be kept under pressure while it cools to avoid excess shrinkage. Heating any thermoplastic material causes expansion and a considerable change in specific volume and specific gravity. Material shrinks during cooling. If this shrinkage is not compensated for by after-feeding of melt while the part is cooling, dimensional inaccuracies, sinkmarks, pitting, and other defects will occur.

Fig. 21 shows the very large differences in specific gravity and specific density between polyethylene and polypropylene. The idea, not infrequently encountered, that a compound must solidify under the high holding pressure of the piston machine to give a dense, solid part is completely different from modern theories. The pressure must be adapted to the character of the mass and the required properties.

In the plasticizing cylinder, the piston machine loses more than half the pressure introduced into it. This pressure loss partly re-appears in the follow-up pressure. The left-hand picture (Fig. 22) of a test piece under polarized light shows what can happen under such conditions. The number and agitation of isochromes indicate great inherent stresses which considerably reduce the strength of the molding. The right-hand picture with far better stress conditions shows a screw machine molding. Cooled under greatly reduced pressure, its strength values are higher in all respects.

Injection speed

Heat is rapidly lost from a material as it flows into a mold. It loses its original high flow properties and, because of the narrow phase at which optimum properties are maintained, can change from the plastic to the elastic state. When this happens, high quality parts can no longer be formed. Pressure, therefore, must be accompanied by an increase in speed which maintains the original optimum flow until the mass particles have assumed their final positions—particularly in the areas where different streams join.

Factors determining injection rate are power load, losses in the plasticizing cylinder, and power requirements within the mold. The screw cylinder is able to attain high injection speeds quickly as shown in Fig. 23. With a conventional ram machine, the speed of the material being injected does not conform to the actual speed of the injection ram. The initial part of the ram stroke is absorbed by the compression of pellets in the feed section. This pressure must be transferred through the heating cylinder with all its restrictions and cushioning effects to the nozzle area.

Viscous material soon loses whatever fluidity it had. Complete filling of the mold becomes more difficult, with subsequent loss of quality and appearance in the finished moldings. On the other hand, material in the nozzle area of the screw machine almost immediately reaches its maximum injection speed. This is because the motion applied to the screw is transferred directly to the melt in the front of the machine.

Fig. 24 shows a relatively large part in rigid vinyl, a material with a very narrow melting range. A short shot was produced to demonstrate the fluidity of the material still existent after a long travel of 11.8 inches through a remarkable small wall thickness (approximately 3/32-inch). The excellent quality of the original melt is evident in the shiny edges around the hole.

The reciprocating screw machine represents a major advance in injection molding technology. A theoretically ideal cycle, however, could only be obtained with a continuously running screw, since any interruption of screw rotation means a change in existing friction and heat convection conditions, plus possible reduction in plasticizing capacity. The Ankerwerk machine is built for cycling with a continuously running screw; however, the screw is usually stopped during the injection and holding pressure period. More often than not, rotation under high injection pressures would produce too much frictional heat and the polymer chain length would decompose or degrade.

Using the right controls on a screw machine, it is possible to approach the optimum of continuous plasticizing. By adjusting the screw speed and back pressure correctly against the reciprocating screw, fully plasticized material for the next shot can be ready at the same instant the mold is closed. The machine is then ready for the next injection. In this way, interruption of screw rotation is limited to the short time it takes to inject a full shot.

Another problem with the reciprocating screw machine is the back-stroke of the screw, since any stroke at all means a changing of the L/D ratio between the forward and rear position (Fig. 26). Theoretically, it would be better if the screw had as short a back-stroke as possible. However, using such a short stroke, we would get only a very small shot capacity as this figure is governed by the formula:

Melt injection volume=cross sectional area of the screw x stroke

The use of a long stroke would be an easy way to enlarge shot capacity, but it also would produce a larger difference in the L/D screw ratios.

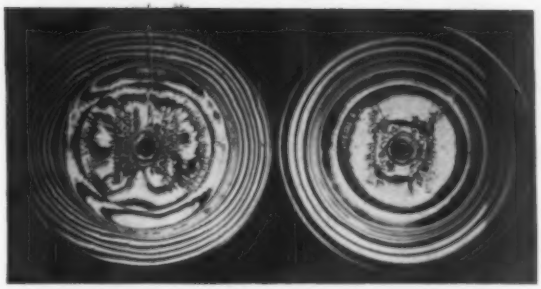

Fig. 22. Polystyrene moldings photographed in polarized light: left, from ram cylinder; right, from screw cylinder.

Machine manufacturers must make a compromise decision to produce a unit giving a good homogeneous melt at a particular shot capacity. Much larger shot capacity can be obtained, but at a sacrifice in homogeneity. A certain amount of injection pressure is lost because of frictional drag of plastic against the cylinder during the injection stroke of the screw. This frictional drag takes place only at that point in the melting state where material has softened just enough to develop surface adhesion to hot metal, but not enough to be reduced to a low viscosity melt. By proper control of heater bands and screw speeds, this melting stage can be limited to a very narrow range of the cylinder profile and, therefore, the loss of total injection pressure is negligible. It is also possible to apply a higher pressure during the injection stroke to overcome this restriction. This pressure is reduced before complete mold filling by means of a micro-switch activated by the screw itself during its forward stroke (See Fig. 11).

As of now, we know only one way to overcome the few undesirable features of a straight, single screw machine. This would, however, reintroduce all the disad-

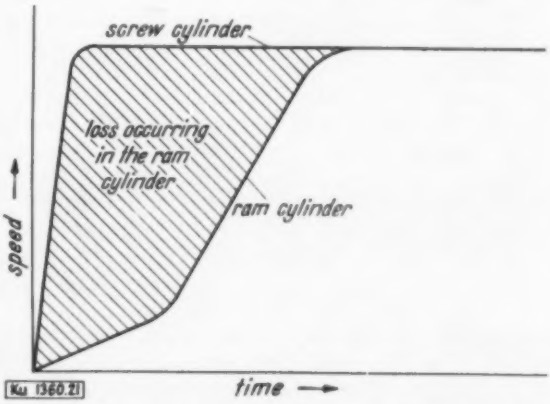

Fig. 23. Speed: time relationship between screw and ram cylinder.

Fig. 24. Large, rigid vinyl part. A short shot using a material with a very narrow melting range. Flow travel is 11.8 inches and wall thickness approximately 3/32-inch.

vantages of preplasticizers: poor heat transfer and laminar flow. Fig. 26 shows such a unit which makes use of a transfer cylinder but, unlike the other preplasticizing units, also applies a displacement of the plasticizing screw.

Plasticizing is done by the screw, and the melt is accumulated in the transfer cylinder. Material is then injected by the ram entering the transfer cylinder. Meanwhile, the continuously running screw is accumulating plasticized material by being pushed rearwards in a similar manner as in the reciprocating single-screw machine. After retraction of the injection plunger, the material accumulated in front of the screw enters the

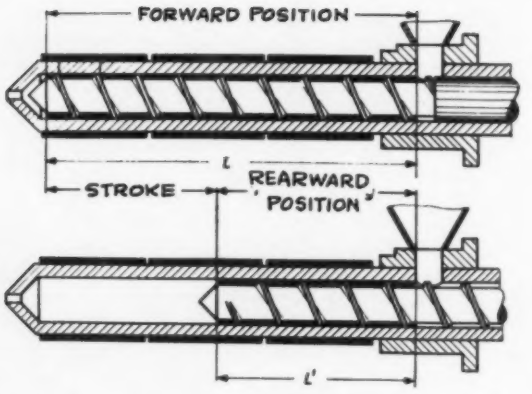

Fig. 25. Reciprocating screw machine's stroke changes the L/D ratio.

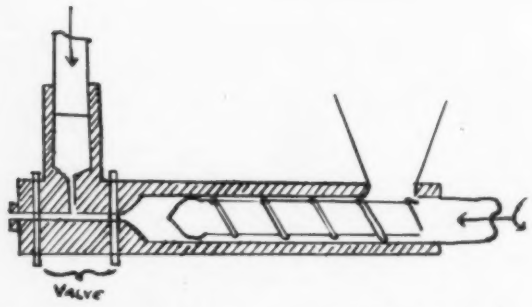

Fig. 26. Reciprocating screw unit with transfer cylinder and displacement of plasticizing screw.

transfer cylinder, followed by additional material as it is plasticized. This continues until, at the proper time, injection takes place.

The theoretical advantage of this system is clear—no interruption of the screw rotation, relatively short screw stroke, no loss of injection pressure, and no loss of plasticizing capacity. Unfortunately, as mentioned earlier, the disadvantages introduced by any other preplasticizer are more important than the advantages gained by avoiding the few shortcomings of single screw injection.

Conclusion

In summary, we have reviewed injection molding machine design over its 30-year history. Weighing the pros and cons of the major design principles, we feel that a reciprocating single-screw machine offers the most favorable balance of positive results over imperfections.

—The End

Special Feature

Ninth National Plastics Exposition

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The Ninth National Plastics Exposition will be held on June 5-9 (designated as "Plastics Week") at the New York Coliseum. Sponsored by the Society of the Plastics Industry, Inc., the show is held every 2½ years (the Eighth National Plastics Exposition was held in Chicago in November 1958; the Seventh in New York in June 1956). By every standpoint, the Ninth National Plastics Exposition will be the largest in the series' history, and will occupy three floors in the Coliseum. Some 260 companies will participate in the show, with more than 450 booths—the new high for these expositions. Concurrently with the Exposition will be the 1961 SPI Annual Conference, whose tentative program is given elsewhere in this special section.

Exhibitors will represent every field in the plastics industry—materials, equipment, processes, and products—coming from all parts of the United States, as well as from many foreign nations. It is anticipated that more than 30,000 visitors from industry and government will attend the Exposition.

There are two important innovations at the forthcoming Exposition: a registration fee of $2.00 from all qualified visitors (the public will be excluded from the show) that is paid only at the time of actual registration; and each visitor is given an Inquiry Timesaver plate as he enters the Exposition—each exhibitor is furnished with a simple imprinting machine that records the visitor's name and address in seconds (similar to the charge plates used by department stores for their charge credit customers).

Robert E. Elder, Plax Corp., is chairman of the Exposition Committee. Clapp & Poliak, Inc., will be Exposition Manager. Publicity for the Exposition and Conference is being handled by G. M. Basford Co.

9th NPE— SYMBOL OF THE FUTURE

ROBERT F. ELDER*

Once again preparations for the major event staged by the plastics industry are nearing completion—the 9th National Plastics Exposition and Conference, sponsored by the Society of the Plastics Industry, Inc., will be held June 5-9, 1961. This is not an annual occasion. The fact that it is staged every two-and-a-half years makes it all the more important that we give it the attention it deserves.

The Exposition gives us the opportunity to see and show the latest developments in every area of our large and booming industry. The Conference offers us a unique chance to hear opinions from people in the plastic industry and from representatives from other industries that consume major quantities of plastics. Other events—the general reception, luncheon, hospitality suites—permit us to get better acquainted with each other and to exchange ideas.

This year we can look forward to the largest and most spectacular Exposition in the history of the industry. Although we have been through a general period of caution, it is obvious that more members of the plastics industry than ever before appreciate the

* President, Plax Corp., Hartford, Conn., and Chairman, 9th National Plastics Exposition Committee.

great value of the Exposition. The Conference, too, promises to be more instructive than previously. By featuring speakers from industries such as building, communications, machinery, packaging, automotive, appliances, and defense, opinions expressed will not necessarily be those of our own industry, rather they will let us know the problems of these other industries so vital to us.

It is anticipated that representation from foreign nations will be greater than ever before, giving us still another opportunity to exchange ideas and learn what is being accomplished abroad.

The 9th National Plastics Exposition and Conference will be a showplace for the industry as it is today and it will represent the phenomenal growth of the industry through the years. This multibillion dollar industry has grown almost 200 per cent in ten years; predicted production of all plastic materials and synthetic resins for 1961 is some six-and-a-half billion pounds.

The relatively young plastics industry has influenced and is influencing every aspect of living from dinnerware to defense equipment. And there is every indication that it will continue to exert this influence at an increasing rate in future years. The Exposition in June is a symbol of the growth and future of our industry—everyone who attends will, I am sure, leave it with an increased feeling of optimism.

How to get the most out of the 9th National Plastics Exposition

L. J. ZUKOR*

Why are you planning to attend the Plastics Exposition? Why invest the time and money? Do you want to investigate new processing techniques? Or find ways of advancing your own industry? Perhaps you want to learn about recent development in machinery and materials—or just make new contacts? All these and more are valid reasons for coming to New York on June 5th, for the 9th National Plastics Exposition at the Coliseum and SPI Conference at the Commodore Hotel.

Held only once every two and a half years, the Plastics Show gives you a rare opportunity to check new materials and methods—in one place and at one time. If you traveled for months, and visited hundreds of plants, you couldn't accomplish the same result. But, just your mere attendance will not get you these results *unless you preplan your visit.*

We all agree that many visitors will waste this opportunity—by excessive "conventioneering." To avoid this, we have a few suggestions:

Avoid fatigue—it's a time killer. If you're familiar with trade shows, you know only too well the energy and time wasted in finding a specific booth, and determining whether it's of value to you. To help you determine your most vital "stops", we are listing exhibitors and floor plans on the following pages. Exhibitors are listed alphabetically with their booth numbers, and in classified lists by material or equipment designations and booth numbers. Floor plans are color-coded for material or equipment and letter-coded to show the predominant processes to which the equipment or materials are adaptable. We are also listing the complete Conference program.

You can best organize your time if, after reading this article and studying the floor plans, you make a memo of the places and people you wish to see at the exposition. This listing can be easily trimmed to essentials when items are set down in a proper time schedule.

Here are some check points which we believe are most important—things for you to do—to get the most out of the exposition:

1. List what you want to accomplish. Do you want to familiarize yourself with the new materials currently available? Or is your interest primarily centered on new, or older, processes which are competing strongly with your present techniques? Perhaps you

* Engineering Editor

want to compare equipment for possible purchase, toward expanding your present operation? Whichever the case may be, it is important to know the objectives of your visit.

2. Write or telephone the men you wish to meet with during the exposition or technical meetings. Appointments are practically a must since time is so short.

3. Jot down specific problems that now confront you in your business. There are sure to be many men at the exposition who will be glad to discuss them with you and help you find possible solutions. One of the big things at this or any other trade exposition is the wealth of specialized knowledge available to you for just being at the right place, at the right time. Our own personnel in attendance in booth 405 will be pleased to discuss market possibilities for your products, equipment or materials. I will be available for consultation on technical or engineering problems you may have.

4. Check the conference program. There are probably several sessions you will want to attend. Possibly some of the papers offer advances in technology in your own field. Remember, it's also wise to know something of the other fellow's field. In many areas of the plastics industry the method or process employed is often the determining factor in achieving maximum production at lowest cost—thus making the difference between profit and loss.

5. Keep a note pad of information acquired at the exposition and conference. Notations of ideas and information may later be worth many times your investment in coming to the exposition. Rate information in terms of urgency and importance. Too, why not take a few minutes out each evening to amplify these notes while they are still fresh in your mind.

6. List names of, or exchange cards with new acquaintances you may want to contact at a later date. Don't forget to take along a good supply of your business cards. You'll need these when visiting with exhibitors at their suites and when attending the conference. At the exposition, however, you will receive a plastic plate, similar to a charge plate, which will be used to machine imprint your business card information at exhibit booths. This will save you lugging around technical and sales bulletins. Whether you received worthwhile material or just a mass of nondescript literature will depend on your own discrimination and how well you identify your needs to the exhibitors.

7. Plan to spend some time with old friends and new in open discussion. Many valuable tips are carried away from just such informal sessions. The plastics industry, of which you are a part, owes much of its success to a continuing search for self-improvement. You will also find a certain freedom, even a unique willingness to swap ideas at the conference—this generally happens whenever a group with common interests gathers.

A National Plastics Exposition couldn't exist without competitive cooperation. Companies investing large sums of money and time for the exposition know, without question, that group meetings are the most economical and productive methods of establishing effective trade and business communications.

8. Check with your current suppliers—they might be exhibiting new products which they are announcing for the first time. Another suggestion—check the ads in this issue; many are specials describing in detail the highlights of that company's exhibit.

9. Check off processes which can offer your company expansion possibilities. Also, any which can diversify your present product line or operations. We have included a check list to facilitate locating specific exhibitors from our classified reference, i.e., exhibits pertaining to the process of extrusion, will be found in the classified list under "extruders."

10. Don't try to tour all three floors of exhibits in a single day—you won't be able to do it. Only a spotty investigation of the exhibits is possible, and very little, if anything, can be properly evaluated and studied. It is best to set time limits in which to cover an area—say a specific type of equipment—on the one day, and other exhibit types on succeeding days. Waiting to get information at a crowded booth is another good way to waste time. Leave your card and make a note to return when proper time can be devoted to you.

The title of this article, "How to get the *most* out of the 9th National Plastics Exposition" is meant to be thought provoking. Many thousands of dollars are wasted annually on "conventions" by participants who attend *without* a clear-cut plan to take advantage of the unique opportunities inherent in such an event. PLAN—and you will be sure to profit by your attendance.

CHECK LIST

A. GENERAL

- ☐ 1. Test equipment
- ☐ 2. Process equipment
- ☐ 3. Product design
- ☐ 4. Mold design and manufacture
- ☐ 5. Safety engineering
- ☐ 6. Quality control equipment

B. MATERIALS

- ☐ 1. Phenolic, urea and melamine
- ☐ 2. Amino
- ☐ 3. Epoxy
- ☐ 4. Urethane
- ☐ 5. Polyester and alkyd
- ☐ 6. Polycarbonate
- ☐ 7. Acetal
- ☐ 8. Polyamide
- ☐ 9. Polyolefin
- ☐ 10. Vinyls and vinylidene
- ☐ 11. Cellulosics
- ☐ 12. Acrylics
- ☐ 13. Silicones
- ☐ 14. Fluorcarbons
- ☐ 15. Compound ingredients

C. PROCESSES AND PROCESSING EQUIPMENT

- ☐ 1. Compression and transfer
- ☐ 2. Extrusion
- ☐ 3. Injection
- ☐ 4. Laminating
- ☐ 5. Blow molding
- ☐ 6. Forming
- ☐ 7. Fabricating
- ☐ 8. Finishing and decorating
- ☐ 9. Casting and potting
- ☐ 10. Sheet and film manufacture
- ☐ 11. Preforming
- ☐ 12. Mixing and milling
- ☐ 13. Coating

D. INTERMEDIATE PRODUCTS

- ☐ 1. Castings
- ☐ 2. Sheets and rods
- ☐ 3. Film
- ☐ 4. Pipe and tubing
- ☐ 5. Reinforced
- ☐ 6. Foams
- ☐ 7. Plastics for tooling
- ☐ 8. Coatings
- ☐ 9. Adhesives
- ☐ 10. Sealants

Alphabetical list of exhibitors and exhibit highlights

	Booth Numbers
A & S Electronic Die Corp., 195 Chrystie St., New York 2, N. Y. *(First handbook on electronic heat-sealing ever published; display an original shuttle for electronic sealing.)*	235
The Acromark Co., 9 Morrell St., Elizabeth 4, N. J. *(Equipment being demonstrated are the Acro-leaf Peripheral Marking Machine Model 9AH, Model 2500H Automatic Feed Rotary Table Press, Acroprinter Model 301, and the Model ETMA.)*	913
Alsteele Engineering Works, Inc., 82 Herbert St., Framingham, Mass. *(Complete line of granulators and pelletizers.)*	130
American Cyanamid Co., Plastics & Resins Div., 30 Rockefeller Plaza, New York 20, N. Y. *(Exhibit of light-stabilized plastics.)*	1141
Intermediate Dept.	414
American Renolit Corp., 419 Park Ave. South, New York 16, N. Y. *(Display of imported clear and colored vinyl films.)*	1545
Apex Machine Co., 14-13 118th St., College Point 56, N. Y. *(Two new marking machines, Model OC-2, two-color high-speed ink press for cylindrical objects; and Model EA-10, air-operated hot stamper for flat items.)*	1301
Argus Chemical Corp., 633 Court St., Brooklyn 31, N. Y. *(Display of applications manufactured abroad but not common in the U. S. In many cases, these applications embody difficult stabilization problems solved with Argus stabilizers.)*	1704
The Arrow-Hart & Hegeman Electric Co., 103 Hawthorne St., Hartford 6, Conn. *(New ambient compensated overload relay for motor protection.)*	610
Atlas Vac-Machine Corp., 1732 Hudson Ave., Rochester 6, N. Y. *(Demonstration of new high-speed in-line form, feed, trim, and seal machine for volume production of containers.)*	1135
Avery Label Co., 1616 S. California Ave., Monrovia, Calif. *(Latest developments in pressure-sensitive materials.)*	210
AviSun Corp., Box 426, Marcus Hook, Pa. *(Demonstration of injection molding with polypropylene; Oleſane U oriented films for packaging.)*	1151
Baker Perkins, Inc., Saginaw, Mich. *(Continuous plastics processing system, from raw powder or pellet resin to uniform hot-cut pellets, that is flexible and suitable for color dispersion work, resin blending, and adding compounding ingredients.)*	321
Ball & Jewell, Inc., 24-28 Franklin St., Brooklyn 22, N. Y. *(New Blender-Loadamatic-Granulator, newly designed Pelletizer, and new Special Granulator.)*	816
Barber-Colman Co., Wheelco Industrial Instruments Div., 1300 Rock St., Rockford, Ill. *(New Indicator Recorder for recording any combination of temperature or pressure.)*	1235
Battenfeld Corp. of America, 959 W. Grace St., Chicago 13, Ill. *(Automatic injection molding machines from ½–7 oz. in capacity.)*	1528
Beetle Chemical Co., Logo Div., 2700 E. 170th St., Lansing, Ill. *(Several new coatings systems used in conjunction with vacuum metallizing of bottle closures and automotive parts; new base and top coat system; new lacquer-type coating for polyolefins.)*	416
Belding Corticelli Industries, 1407 Broadway, New York 18, N. Y. *(Company's resins shown in moldings and extrusions.)*	215
Berton Plastics, Inc., 79 Fifth Ave., New York 3, N. Y. *(Raw materials and products in the reinforced plastics industry.)*	835
Black-Clawson Co., Hale & Kullgren Plastics Dept., Dilts Div., 613 E. Tallmadge Ave., P.O. Box 1231, Akron 10, Ohio *(New 2½-inch Model 150 Induction Heated Extruder.)*	1347
C. W. Brabender Instruments, Inc., 50 East Wesley St., South Hackensack, N. J. *(Instruments for testing viscosity, plasticity, and moisture in all types of polymers.)*	1229
Cary Chemicals, Inc., P.O. Box 1128, New Brunswick, N. J. *(Vinyl information center; new all-vinyl conduit and shoes; discussion of company's expansion program.)*	719
Catalin Corp. of America, 1 Park Ave., New York 16, N. Y. *(Styrene, polyethylene, nylon, polypropylene, phenolic, urea, cresylic, melamine, acrylic, and resorcinol resins; antioxidants for polyethylene, polystyrenes, and other polymers.)*	1017
Ciba Products Corp., P.O. Box 415, Fair Lawn, N. J. *(Comprehensive display of epoxy resin products.)*	436
Claremont Pigment Dispersion Corp., 39 Powerhouse Rd., Roslyn Heights, N. Y. *(New line of soft metallic colorants in a complete range of shades; new Owikmil line of colorants for calendered or extruded vinyl.)*	1309
Coating Products, Inc., 101 W. Forest Ave., Englewood, N. J. *(Metallized plastic films, including acetate, vinyl, polystyrene, butyrate, and polyester.)*	504
Comet Industries, Inc., 9865 Franklin Ave., Franklin Park, Ill. *(Products produced by thermoforming.)*	1308
Conapac Corp., 120 East 13th St., New York 3, N. Y. *(Three Rotojet injection molding machines; Models T-5, T-25, and T-50.)*	1414
Conforming Matrix Corp., 830 New York Ave., Toledo 11, Ohio *(Latest developments in spray painting machines, masks and their maintenance, and spray fixtures.)*	1200
Crystal-X Corp., W. Lenni Road, Lenni Mills, Pa. *(Prefabricated inflatable vinyl dome.)*	429
Cumberland Engineering Co., Inc., P.O. Box 216, Providence 1, R. I. *(New models of pelletizing machines and stair-stepping dicing machine.)*	1100
Custom Scientific Instruments, Inc., 541 Devon St., Kearny, N. J. *(Dow Gas Transmission Console; Pittsburgh Corning Thermal Conductivity Probe; FRL Environmental Test Chamber.)*	916
Dake Corp., 724 Robbins Road, Grand Haven, Mich. *(New Model 49-050 Automatic Compression Molding Machine; display of 25-ton compression press for reinforced plastics.)*	1521
Davidson & Hemmendinger, 2857 Nazareth Road, Easton, Pa. *(Colorant Mixture Computer.)*	1317
Detroit Mold Engineering Co., 6686 McNichols Rd., Detroit 12, Mich. *(Line of standard mold base assemblies for injection and compression molding; line of standard ejector pins, core pins, ejector sleeves, and moldmaker's tools and polishing supplies.)*	1442
Diamond Alkali Co., 300 Union Commerce Bldg., Cleveland 14, Ohio *(New concepts in PVC technology, with major emphasis on metal coating and rigid PVC.)*	1606
E. I. Du Pont de Nemours & Co., Inc., 1007 Market St., Wilmington 98, Del., Electrochemicals Dept. *(Data on the company's new solvent for PVC and other high molecular-weight resins.)*	1018
Film Dept.	1024
Polychemicals Dept. *(End-use display of the company's polyethylene, acetal, acrylic, methacrylate monomer, nylon, and fluorocarbon resins.)*	1104
Dura Plastics of New York, Inc., 303 Fifth Ave., New York 16, N. Y. *(Display of samples showing precision fabricating of acrylic, nylon, and Teflon resin products.)*	301
Frank W. Egan & Co., P.O. Box 671, 671 S. Adamsville Rd., Somerville, N. J. *(Demonstration of extrusion casting unit, including 2½-inch extruder, sheeting die, chill roll unit, take-up, and winder.)*	336
Emery Industries, Inc., 4200 Carew Tower, Cincinnati 2, Ohio *(Display built around use of plasticizers in vinyls.)*	731
Erie Engine & Mfg. Co., 953 S. 12th St., Erie, Pa. *(Booth shared with Molded Fiberglass Corp. and Molded Fiberglass Tray Co., showing actual molding of reinforced fiberglass.)*	802
Falcon Mfg. Div., The First Machinery Corp., 209 – 10th St., Brooklyn 15, N. Y. *(Top-Flight and Heavy-Duty Sanitary Double Ribbon Blenders on exhibit.)*	919
Farris Universal Machine Corp., 400 Commercial Ave., Palisades Park, N. J. *(New Universal Take-Off Machine Model D500 will be displayed.)*	730

Booth Numbers

The Fellows Gear Shaper Co., Inc., 78 River St., Springfield, Vt. 619
(Demonstration of a 3-125 Injection Molding Machine having a rotary spreader in the heating cylinder.)

Ferro Corp., 4150 East 56 St., Cleveland 5, Ohio 421
(The company's Fiber Glass Division will display its complete line of fiberglass; the Chemical Division will display its line of PVC stabilizers; and the Color Division will feature its new non-dusting color pigments.)

Fiberfil, Inc., Fox Farm Road, Warsaw, Ind. 1518
(Featuring the improved dimensional stability and mechanical properties offered by fiberglass-reinforced nylon, polystyrene, acrylonitrile, and polycarbonate.)

Finish Engineering Co., Inc., 921 Greengarden Rd., Erie, Pa. 616
(Masks, vacuum plating racks, painting machines, mask washers, paint wipers, painting fixtures, decorating screens, roller coaters, and combination paint and wipe machines.)

Firestone Plastics Co., P.O. Box 690, Pottstown, Pa. 1009
(Display of products made from the company's materials, including PVC resins, copolymer resins, molding compounds, latices, and nylon and polypropylene compounds.)

Fitchburg Paper Co., 642 River St., Fitchburg, Mass. 614
(New Gold Fleck Overlay for lamination work.)

Food Machinery & Chemical Corp., Chemicals & Plastics Div., 161 East 42 St., New York 17, N. Y. 1404
(Display of products made from Oxiron epoxy resins, Dapon diallyl phthalate resins, and plasticizers.)

Foster & Allen, Inc., 26 Commerce St., P.O. Box 27, Chatham, N. J. 425
(Versa Cutters; Versa Feeds; precision controls; Versa Cutter Model 21; caterpillar conversion take-off unit; and wide bushing attachment for Model F-7 Versa Cutter.)

Foster Grant Co., Inc., 289 N. Main St., Leominster, Mass. 1434
(Molding and extrusion grades of Fostarene, Fosta Tu-Flex, Fostalite polystyrene resins, and Fosta Nylon resins.)

J. P. Frank Chemical & Plastic Corp., 5410 Avenue "U," Brooklyn 34, N. Y. 1634
(Complete range of vinyl chloride homopolymer and copolymer resins; plasticizers; stabilizers; chelating agents; and vinyl inks, film, and sheet.)

Geigy Industrial Chemicals Div., Geigy Chemical Corp., P.O. Box 430, Yonkers, N. Y. 817
(Line of specialty chemicals for the plastics industry, and unveiling several new compounds for plastics.)

General Aniline & Film Corp., 435 Hudson St., New York 14, N. Y. 1053
(Range of Uvinul U-V absorbers, Gafac surfactants, and two new pigments for coloring plastics.)

General Electric Co., Chemical Materials Dept., 1 Plastics Ave., Pittsfield, Mass. 1116
(Largest display ever built in this country on Lexan polycarbonate resins and phenolic molding powders, and their applications.)

Girdler Process Equipment Div., Chemetron Corp., 334 E. Broadway, Louisville 1, Ky. 1325
(New automated Thermex preform handling system.)

Glamorgan Plastics Div., Glamorgan Pipe & Foundry Co., Lynchburg, Va. 1633
(Type I and Type II PVC pipe and Marlex gas pipe; demonstrating Butt-Fusion Weld Process on Marlex pipe.)

Glass Laboratories, Inc., 863 65th St., Brooklyn 20, N. Y. 208
(Display of products using Silvatrim plastic trim molding to simulate brass, chrome, copper, or golden appearance.)

B. F. Goodrich Chemical Co., 3135 Euclid Ave., Cleveland 15, Ohio 1025
(Display of products made by the company's customers, emphasizing Estane polyurethane material, Abson materials, and hi-temp Geon vinyl compounds.)

Goodrich-Gulf Chemicals, Inc., 1717 East 9th St., East Ohio Bldg., Cleveland 14, Ohio 1618
(Ameripol h-d polyethylene under continuous comparative burst and flexing tests.)

W. R. Grace & Co., Polymer Chemicals Div., 225 Allwood Rd., Clifton, N. J. 1108
(Company's low-, medium-, and high-density polyethylenes shown in a variety of fabricating techniques, including blow molding, extrusion, injection molding, wire and cable coating, and vacuum forming.)

Gries Reproducer Corp., 127 Beechwood Ave., New Rochelle, N. Y. 1549
(Featuring the company's special automatic technique for making small precision moldings, with emphasis on usages for Delrin acetal resin.)

Guild Electronics, Inc., 388 Broadway, New York 13, N. Y. 1250
(Demonstration of Dynatherm Electronic Heat Sealing equipment.)

Hendrick Mfg. Corp., 11 Selman St., Marblehead, Mass. 633
(Model TRA Panel Saw displayed.)

Hercules Powder Co., Inc., Delaware Trust Bldg., 910 Market St., Wilmington 99, Del. 1129
(All materials for plastics made by the company, with emphasis on Hi-fax h-d polyethylene, Pro-fax polypropylene, and Penton chlorinated polyether. Also displayed will be pigments, plasticizers, resins, and Spiralloy glass-reinforced plastics.)

Hermsdorf Industries, Inc., 108 Franklin St., Manchester, N. H. 1546
(Display of custom-injection, formed, and foam moldings.)

Hooker Chemical Corp., Durez Plastics Div., 88 Walck Road, North Tonawanda, N. Y. 305
(Phenolic molding compounds, phenolic resins, Hetron polyester resins, and Hetrofoam rigid polyurethane foam systems.)

Hull Corp., 1941 Woodland Road, Hatboro, Pa. 631
(Display of company's line of thermosetting plastics molding machinery and liquid resin metering, mixing, and dispensing equipment; new Model 99A transfer molding press.)

Hurlbut Paper Co., South Lee, Mass. 508
(Papers in decorative and industrial saturating grades.)

Husky Mfg. & Tool Works (Ontario), Ltd., 200 Bentworth Ave., Toronto 19, Ont., Can. 1738
(In operation: two injection molding machines, Swiss Netsal 260/500 and Husky HM15/19.)

The Hydraulic Press Manufacturing Co., Div. of Koehring Co., Marion Rd., Mount Gilead, Ohio 320
(Two-stage screw-type preplasticizing injection molding machine.)

Improved Machinery, Inc., 150 Burke St., Nashua, N. H. 505
(Exhibit of latest injection molding machine models in operation, featuring screw plastification.)

Industrial Manufacturing Corp., 31 E. Georgia St., Indianapolis 4, Ind. 1231
(Thermolators for control of mold or roll temperatures.)

Industrial Nucleonics Corp., 650 Ackerman Rd., Columbus 2, Ohio 716
(Display demonstrating industrial uses of radioisotopes to continuously and automatically measure and control production of plastic film and sheet.)

Industrial Research Laboratories, Div. of Honolulu Oil Corp., 961 Slauson Ave., Los Angeles 11, Calif. 946
(Xaloy cylinder liners.)

Injection Molders Supply Co., 17601 S. Miles Rd., Cleveland 28, Ohio 1420
(Display of company's stock equipment in photo form only, with emphasis on the Vented Reverse Flow Heating cylinder.)

Instron Engineering Corp., 2500 Washington St., Canton, Mass. 810
(Exhibit will focus on the company's unique line of universal testing instruments, with emphasis on the new Capillary Rheometer.)

Instrument Development Laboratories, Inc., 67 Mechanic St., Attleboro, Mass. 1621
(New Model "D" Color-Eye dual purpose colorimeter and abridged spectro-photometer.)

Interchemical Corp., 67 West 44th St., New York 36, N. Y. 622
(The company's Finishes Division will feature polyester resins, gel coats, color concentrates, and accessories for reinforced-plastics molding; the R-B-H unit of the Color & Chemical Division will show color concentrates for vinyl, polystyrene, polyethylene, and cellulose acetate; and IPI will feature process inks for plastics films.)

Johns-Manville Sales Corp., 22 East 40th St., New York 16, N. Y. 834
(Photo montage showing applications for glass-reinforced plastics in the construction, transportation, and general industrial fields, as well as displays of various processes for making them.)

Jones-Dabney Co., 1418 S. 11th St., Louisville 8, Ky. 410
(Technical information center and display of applications for its Epi-Rez epoxy resins and Epi-Cure curing agents.)

Oscar L. Judelshon, Inc., 148 Greene St., New York 12, N. Y. 915
(New Model 313 Unicut Automatic Single Knife Plastic Film Slitter, and new Model 445 Razor Blade Slitter and Winder.)

Kautex Machines, Inc., 536 E. Elizabeth Ave., Linden, N. J. 1537
(Display of Model V 18 automatic two-color blow molding machines and Model V 8 automatic blow molding machine.)

Kensol-Olsenmark, Inc., 124 White St., New York 13, N. Y. 1321
(Demonstration of actual hot stamping on linear polyethylene, using the Kensol 36T Roll Leaf Stamping Press.)

Killion Tool & Mfg. Co., 56 Depot St., Verona, N. J. 1622
(Demonstration of new 1-inch laboratory extruder.)

E. B. Kingman Co., Inc., 96 Exchange St., Leominster, Mass. 401-4
(Display of injection molded and extruded products as a custom molder.)

H. Kohnstamm & Co., Inc., 161 Avenue of the Americas, New York 13, N. Y. 408
(Complete line of colors for thermoplastic resins.)

Koppers Co., Inc., Koppers Bldg., Pittsburgh 19, Pa. 535
(Samples of products made from Super Dylan h-d polyethylene, Dylan polyethylene, Dylene polystyrene, Dylite expandable polystyrene, and Durethane polyethylene film.)

W. T. La Rose & Associates, Inc., Troy, N. Y. 428
(Various types and sizes of Thermall high-frequency plastics preheaters will be shown and demonstrated.)

Lawter Chemicals, Inc., 3550 Touhey Ave., Chicago 45, Ill. 1305
(Company's line of Hi-Viz fluorescent pigments.)

Lembo Machine Works, Inc., 248 East 17th St., Paterson 4, N. J. 1529
(Exhibit of Lembo Laboratory Laminator Embosser.)

Lester-Phoenix, Inc., 2623 Church Ave., Cleveland 13, Ohio 1224
(Exhibit of two machines; one dry-cycling, and the second actually molding.)

Lombard Governor Corp., Ashland, Mass. 1637
(Exhibit of Lembo Laboratory Laminator Embosser.)

Marbon Chemical Div., Borg-Warner Corp., Box 68, Washington, W. Va. 1605
(Feature will be full-scale cutaway of an automobile demonstrating advantages of Cycolac plastic for all interior components in the car of tomorrow.)

Martin Engineering Co., Neponset, Ill. 1726
(Operating 4½-oz. Little Giant vibrators, and CCVP 375 Big Shake vibrator.)

Mesa Plastics Co., 12270 Nebraska Ave., Los Angeles 25, Calif. 722
(Demonstration that certain molded parts can be exposed continuously to 500° F.; also that certain plastics can be magnetized.)

Minnesota Mining & Mfg. Co., 900 Bush Ave., St. Paul 6, Minn. 1438, 1626
(Kel-F brand plastics and Cardolite brand epoxy resin flexibilizer N-153.)

Mitchell Specialty Div., Novo Industrial Corp., Edmund & Shelmire Sts., Phila. 36, Pa. 825
(Demonstration of two late NoVo Metering, Mixing, and Dispensing Machines for handling reactive resin formulations.)

Mobay Chemical Co., 1815 Washington Rd., Pittsburgh 34, Pa. 1333
(Commercial and experimental applications for Texin urethane elastomer product for molding and extrusion will be displayed; Mobay Products Co. will exhibit industrial applications for Merlon.)

Modern Plastic Machinery Corp., 64 Lakeview Ave., Clifton, N. J. 120
(WSF Casting Roll Unit for high-speed handling of film in 0.001-0.030 inch thickness.)

Monsanto Chemical Co., 800 N. Lindbergh Blvd., St. Louis 66, Mo. 1215, 1315
(The Organic Chemicals Div. will feature Phosgard flame-retardant organophosphorous compounds and Santicizer polymeric plasticizers; The Plastics Div. will have a display of actual applications of the company's materials and a demonstration of injection molding Lustran SAB.)

Moslo Machinery Co., 2443 Prospect Ave., Cleveland 15, Ohio 138
(Exhibit Model 1246 Duplimatic blow molder, Model 46-12-300T Horizontal Injection Molding Machine, and Model 2-12-85T Horizontal Injection Molding Machine; and demonstration of injection blow molding.)

National Lead Co., 111 Broadway, New York 6, N. Y. 335
(Demonstration of a mechanical dipping operation, and exhibits of vinyl stabilizers, Bentone gelling agents, and end-products.)

National Rubber Machinery Co., 47 W. Exchange St., Akron 8, Ohio 221
(New Vanguard line of 3½- and 2½-inch extruders; 48-inch Trimmed Width Type MIH Sheetine Die; 6-inch Pacemaker induction heated, liquid cooled thermoplastic extruder; and Vacuum Hopper mounted on 6-inch extruder—no machines will be operated.)

Newark Die Co., 24 Scott St., Newark 2, N. J. 634
(Photos of shop operations in making molds, featuring an injection mold for molding closures; and exhibit of mold components.)

Newbury Industries, Inc., Route 87, Newbury, Ohio 737
(Exhibit six Mini-jector injection molding machines; featuring two new hydraulic automatics, Imperial and Auto-Hornet; the latter will operate continuously.)

Nixon-Baldwin Chemicals, Inc., Nixon, N. J. 407
(Exhibit company's line of thermoplastics.)

Nopco Chemical Co., Plastics Div., 60 Park Place, Newark 1, N. J. 851
(Exhibit of Lockfoam pour-in-place urethane foam and its applications; Nopcofoam slabs, sheets, and usages; new Lockfoam H-602 foam for low-temperature insulation; and special polyester urethane foam for garment interlinings.)

Novamont Corp. (Represented by Chemore Corp., 2 Broadway, New York 4, N. Y.) .. 1241
(Montecatini products and applications: Moplen polypropylene resin, Moplefan polypropylene film, and Meraklon polypropylene fiber.)

Nuodex Products Co., Div. of Heyden-Newport Chemical Corp., Box 242, Elizabeth, N. J. 615
(Featuring vinyl stabilizers, organic peroxide catalysts and accelerators, and urethane foam catalysts.)

Nypel Corp., Ford Bridge, W. Conshohocken, Pa. 206
(Nylon molding powder and monofilament.)

Omni Products Corp., 460 Fourth Ave., New York 16, N. Y. 529
(Booth will render international distributing services to all visitors.)

Packaging Industries Limited, Inc., 151 Pine St., Montclair, N. J. 1559
(Blister heat-sealing equipment.)

Pallmann Pulverizers Co., Inc., 315 Newark St., Hoboken, N. J. 1722
(Demonstration of new principle in grinding that permits conversion of polyethylene pellets to powder without addition of any coolants.)

Pamarco, Inc., Roselle, N. J. 829
(Embossing rolls, gravure base cylinders, and rolls of all types.)

Paterson Parchment Paper Co., Bristol, Pa. 1612
(Photos and actual production samples of end-use applications for Patapar Brand Releasing Parchments and PPP Brand Overlay Papers.)

Peerless Roll Leaf Co., 4511–23 New York Ave., Union City, N. J. 833
(Various types of machinery for hot-stamping and roll leaf stamping of plastics.)

Pittsburgh Chemical Co., Industrial Chemicals Div., 485 Lexington Ave., New York 17, N. Y. 220
(Exhibit showing rapid expansions of company to ensure adequate supplies of specialty chemicals to the plastics industry.)

Pittsburgh Plate Glass Co., Fiber Glass Div., 632 Fort Duquesne Blvd., Pittsburgh 22, Pa. 1203
(Line of fiberglass reinforcement products, including roving chopped-strand mat, and chopped strand.)

Plastic Molders Supply Co., Inc., 74 South Ave., Fanwood, N. J. 901
(Exhibit of molded samples in color, both Kleen Kolor Dry Colorants and Master Batch colors.)

Plastics Engineering Co., 1607 Geele Ave., Sheboygan, Wisc. 329
(Variety of parts and components molded from Plenco phenolic, melamine-phenolic, and industrial resins.)

"PLASTICS TECHNOLOGY," 630 Third Ave., New York 17, N. Y. 405

"Plastics World," 247 Park Ave., New York 17, N. Y. 1000

Plast-O-Craft Co., Inc., 391 Mulberry St., Newark 5, N. J. 1734
(Operating automatic 24 x 30 vacuum forming machine and NO. 81 Test-Vac unit.)

Poloron Products, Inc., 165 Hugenot St., New Rochelle, N. Y. 1251
(Consumer products made of vinyl-to-metal laminate and expanded polystyrene.)

The Polycast Corp., 69 Southfield Ave., Stamford, Conn. 1148
(General display of clear, pattern, and color acrylic sheets.)

The Polymer Corp., 2120 Fairmount Ave., Reading, Pa. 1050
(Industrial plastics of polypenco nylon formulations, Nylatron GS, MC Nylon, Teflon TFE fluorocarbon, Fluorosint TFE, Nylaflow, polycarbonate, Nylasint pressed and sintered nylon parts, and Corvel plastic coatings.)

Porous Plastics Ltd., 137 Victoria St., London S.W. 1, England 1635
(Exhibit of Vyon porous plastic made from high-density polyethylene.)

Premier Vacuum Process Corp., 58-87 55th St., Maspeth 78, N. Y. 600
(Exhibit of finished parts of all materials, both plastics and metals, whose finish cannot be distinguished from metallizing.)

Printloid, Inc., 1010 - 44th Ave., Long Island City, N. Y. 831
(Display of custom fabricated cards and card-products protected with a film or sheet of acetate, Vinylite, butyrate, Plexiglas, or polystyrene.)

Prodex Corp., King George Post Road., Fords N. J. 1001
(Display of compact and high-torque extruders; mixers; and blow-molding machines.)

Producto Machine Co., Plastics Machinery Div., 990 Housatonic Ave., Bridgeport 1, Conn. 1501
(New Versa Blow Molding Machine, new Laboratory Pressure Forming Machine, and new bottle reaming equipment.)

Progressive Tool & Die Co., 530 Boston Turnpike, Shrewsbury, Mass. 1724
(Mercury VMM-1 Vertical Injection Molding Machine.)

Radiant Color Co., 461 W. Erie St., Chicago 10, Ill. 123
(Display of plastics samples with fluorescent colors.)

The Rainville Co., Inc., 839 Stewart Ave., Garden City, N. Y. 121, 427
(Booth 121—Rainmark Hot Stamping Equipment, Rainco Vacuum Hopper Loaders, and Autotherm Temperature Control Units; Booth 427—Drying and dehumidifying equipment, extrusion accessories.)

Raritan Plastics Corp., 1 Erie St., Paterson 1, N. J. 1614
(Display of flexible and rigid plastic sheet made from polystyrene, polyethylene, and ABS plastic; ribbed floor runner made of polyethylene; and decorative polystyrene, laminates, including new designs.)

Ravco Plastics, 119 Railroad Ave., Norwood, Mass. 1561

Reed-Prentice Div., Package Machinery Co., 330 Chestnut St., East Longmeadow, Mass. 721
(New Model 450TC Injection Molding Machine; display interchangeable mold clamping mechanisms and injection units.)

Regal Plastic Co., 1725 Holmes St., Kansas City 8, Mo. 924

Reichhold Chemicals, Inc., RCI Bldg., 525 N. Broadway, White Plains, N. Y. 522
(Company's line of epoxy, phenolic, polyester, and polyurethane resins; glass mat and veil; line of catalysts, plasticisers, and stabilisers.)

Reifenhauser U. S. Sales Corp. (Represented by Heinrich Equipment Corp., 111 - 8th Ave., New York 11, N. Y.) 1205
(Exhibition of late 4½-inch extra-long extruder and smaller 1½-inch lab. extruder.)

Reliable Rubber & Plastics Machinery Co., Inc., 2014 Union Turnpike, North Bergen, N. J. 636
(Exhibit and operate 3 x 8- and 6 x 13-inch mills, and 6 x 13-inch three-roll calender.)

Rexall Chemical Co., P.O. Box 37, Paramus, N. J. 1613

Robeco Chemicals, Inc., 25 East 26th St., New York 10, N. Y. 303
(Display clear calendered, extruded, and press-polished vinyl film and sheeting, rigid vinyl corrugated panels, clear rigid tubular vinyl film, metallized vinyl film, and rigid vinyl pipe.)

Roehlen Engraving Works, Inc., P.O. Box 412, 324 St. Paul St., Rochester 2, N. Y. 1234

Rohm & Haas Co., 222 W. Washington Sq., Philadelphia 5, Pa. 928
(Plexiglas acrylic outdoor signs; Plexiglas and Implex molding powders; applications of polyester resins in reinforced-plastic sheets; and company's line of plasticizers.)

Roll-Die & Mold Decorators, Inc., P.O. Box 2493, 3713 Oakwood Ave., Youngstown 9, Ohio 1338
(Wall display of injection molded items and plaques, showing suitably of company's decorative procedure.)

David H. Rosenstock, P.O. Box 78, 132 Paterson Ave., E. Rutherford, N. J. 1337
(Kay Anti-Wrinkle Slat Expander.)

Charles Ross & Son Co., Inc., 148–156 Classon Ave., Brooklyn 5, N. Y. 1555
(New Model 42-FS-1 Spiral Ribbon Blender; also display of Model 52L 4 x 8-inch three-roll mill and other three-roll mills. Model 41-A one-quart Kneader, and Model 140DL lab-size High Speed Disperser.)

John Royle & Sons, 10 Essex St., Paterson 3, N. J. 1712
(Complete operational plastic pipe extrusion line on ABS pipe compound, including 2½-inch extruder, pipe sizing and cooling tank, printing unit for marking the pipe, haul-off unit, and cut-off saw; display of wide range of extrusion dies and new sheeting die.)

Sanitized Sales Co. of America, Inc., 53 East 34th St., New York 16, N. Y. 1328
(New Sanitized formula for plastics not previously compatible with existing bacteriostats; display of treated merchandise.)

Sartomer Resins Co., P.O. Box 56, Governor Printz Blvd. & Wanamaker Ave., Essington, Pa. 1542
(New line of methyl methacrylate resins containing lock-in pigments.)

Herman Schwabe, Inc., 189 S. Portland Ave., Brooklyn 17, N. Y. 847
(Dytraulic line of Hydraulic Die Cutting Machines; display of hydraulic presses and automatic die cutting machines.)

Sealomatic Electronics Corp., 75 Scott Ave., Brooklyn 37, N. Y. 501

Shell Chemical Corp., 50 West 50th St., New York 20, N. Y. 516
(Display of Epon epoxy resins; polystyrene, polyethylene, and polypropylene molding materials.)

The Simco Co., 920 Walnut St., Lansdale, Pa. 905
(Exhibit of static eliminators for all types of plastics and plastic fabricating machinery; new Type ME Shockless Static Bars; Ionizing Air Guns and Nozzles, Aerostats, Bottle Cleaning Nozzle, Electrostatic Locator, Neutro-Stat spray, dip, and wiping liquid and animated display of static and its elimination.)

Snia Viscosa, 350 Fifth Ave., New York 1, N. Y. 1525
(Display of molded toys, housewares, and industrial items.)

Solar Chemical Corp., Solar Park, Leominster, Mass. 1418
(Display samples of company's polystyrene powder.)

Spencer Chemical Co., 610 Dwight Bldg., Kansas City 5, Mo. 413
(New Poly-Eth 1018 polyethylene coating resin; display of applications for company's thermoplastics—Poly-Eth, Poly-Pro, and Nylon; demonstration of Revell Poly Art hobby kit using the company's Poly-Eth to create works of art.)

Standard Tool Co., 217 Hamilton St., Leominster, Mass. 105, 201
(Booth 105—New 3–6 oz. molding machine with screw plasticizer; Model K2-50-50 molding machine in operation. Booth 201—Display of various types of molds, mold cavities, and mold components.)

Sterling Extruder Corp., 1537 W. Elizabeth Ave., Linden, N. J. 826
(Exhibit extruder complete with instrumentation, various components and dies.)

Sterling, Inc., 5200 W. Clinton Ave., Milwaukee 23, Wisc. 920
(Display of various units of mold temperature control equipment.)

F. J. Stokes Corp., 5500 Tabor Rd., Philadelphia 20, Pa. 227
(New—Model 706 automatic injection molding machine in actual operation. Display of line of automatic and semi-automatic compression and transfer molding machines, with Model 741 75-ton automatic compression unit in operation.)

Stokes-Trenton, Inc., 150 Enterprise Ave., Trenton 9, N. J. 1336
(Display of mold cavities of all types; special exhibit of all types of plastic gears and threads, and their tooling.)

Switzer Brothers, Inc., 4732 St. Clair Ave., Cleveland 3, Ohio 918
(Day-Glo daylight fluorescent pigments for all plastics.)

Thermatron Div., Willcox & Gibbs Sweing Machine Co., 214 W. 39th St., New York 18, N. Y. 1216
(Complete line of electronic h-f welding equipment.)

Thermel, Inc., 9400 W. Robinson Rd., Franklin Park, Ill. 422
(Display of Thermatube heating elements, Thermaband heater bands, Thermaplatens, Thermaheaters, Thermarolls, Thermatrol pipe heaters, and Thermatrace.)

Thermo-Dielectric Machine Co., Inc., 692 Broadway, New York 12, N. Y. 1331
(New Stamp-O-Mark and Automatic Roller Feed machines; demonstration of high-frequency heat-sealing machines for vinyl.)

Thoreson-McCosh, Inc., 18208 W. McNichols Rd., Detroit 19, Mich. 131

J. G. Tilp, Inc., Milltown Rd., Union, N. J. 917

Tote Systems, Inc., 710 S. 7th St., Beatrice, Nebr. 1329
(Exhibit Tote Bin filled with polyethylene that will discharge into a portable hopper and conveyor to recycle back into the bin.)

A. Triulzi, S.A.S., 56 Via Vialba, Novate Milanese, Italy 1623

Tronomatic Machine Mfg. Corp., 25 Bruckner Blvd., New York 54, N. Y. 830
(Exhibit Junior Vacuum Former, and Automatic Vacuum Former working in conjunction with die cutter.)

Union Carbide Chemical Co., 270 Park Ave., New York 17, N. Y. 929

Union Carbide International Co., 270 Park Ave., New York 17, N. Y. 929
(Display plastics around the world, and serve as a reception area for overseas customers and friends.)

Union Carbide Plastics Co., 270 Park Ave., New York 17, N. Y. 929

United States Gypsum Co., 300 W. Adams St., Chicago 6, Ill. 1350
(Display of epoxy and gypsum cement models and molds used in vacuum forming, prototype fabrication, and industrial tooling; hourly demonstration of mold fabrication methods.)

U. S. Industrial Chemicals Co., Div. of National Distiller & Chemical Corp., 99 Park Ave., New York 16, N. Y. 304
(Five basic areas—film extrusion, coating and laminations, injection molding, blow molding, and wire coating and pipe extrusion—each with displays providing dramatic forecasts on market development through 1963, and examples of outstanding polyethylene products.)

U. S. Naval Ordnance Lab., White Oak, Silver Spring, Md. 3rd Floor
(Display of various materials and processes by the laboratory, primarily for use in connection with missiles, and featuring a new monitoring device for studying materials during potting and casting.)

U. S. Rubber Co., 2638 N. Pulaski Rd., Chicago 39, Ill. 1004

U. S. Stoneware Co., 5300 E. Tallmadge Ave., Akron 9, Ohio 1610
(Plastics processing equipment displayed, including lab grinding and mixing, ball and

	Booth Numbers
pebble mills, conical blenders, fibre and steel drum tumblers, drum rollers, and special grinding and mixing equipment.)	
Universal Unlimited, Inc., Pratt Oval, Glen Cove, N. Y. *(Exhibit typical formed and processed thermoplastic products.)*	400
The Van Dorn Iron Works Co., 2685 E. 79th St., Cleveland 4, Ohio	625
Waldron-Hartig Div., Midland-Ross Corp., P.O. Box 791, New Brunswick, N. J. *(New—Blow Molding Package including T-line extruder and control system in operation; demonstration of 24-inch Turnareel Wind for light films; New—Hydraulic Screen Changer; Display of new preplasticiser for injection machines, and important components of the T-line extruder.)*	811
Wallace & Tiernan, Inc., Harchem & Lucidol Divs., 25 Main St., Belleville 9, N. J. *(Harchem Division: display product samples of their plasticizers. Lucidol Division: Display its line of peroxide-type catalysts.)*	125
Warminster Fiberglass Co., Box 64, Warminster, Pa.	300
Watson-Stillman Press Div., Farrel-Birmingham Co., Inc., 565 Blossom Rd., Rochester 10, N. Y. *(New Model 12-20 Hydraulic Plunger and Screw-Type Injection Molding Machines in operation.)*	521
Waynco, Inc., Box 303, Winona, Minn.	951
Welding Engineers, Inc., P.O. Box 391, Norristown, Pa.	230
Weldotron Corp., 841 Frelinghuysen Ave., Newark 12, N. J. *(Complete line of thermal impulse sealing equipment, including new manual units; new line of contour sealing machines; new line of SP series h-f sealing equipment; new line of hot-air welding devices; new series of transistorized electronic control devices for automatic packaging machinery; and demonstration of of techniques for shrink packaging with new sealing machine and new conveyorized shrink tunnel.)*	207
West Instrument Corp., 4363 W. Montrose Ave., Chicago 41, Ill.	1332
Wheelabrator Corp., 1414 S. Byrkit St., Mishawaka, Ind. *(Continuous operation of Plastics Deflasher machine and Dustlube cloth-type dust collector.)*	635
Whitlock Associates, Inc., 21655 Coolidge Highway, Oak Park 37, Mich. *(Series of Pneumatic Conveyors, including new Metering Conveyor and a Vacuum Conveyor, in actual comparative operation; Demonstration of a Dehumidifying Dryer.)*	1422
Edwin L. Wiegand Co., 7500 Thomas Blvd., Pittsburgh 8, Pa.	536
World Plastics, 1685 Boone Ave., New York 60, N. Y. *(Educational display of many finished products embodying components made by the company.)*	911
Zimmer Plastic Maschinen-Gesellschaft Gmbh Frankfurter Strasse 74, Offenbach/Main, Germany	1509
	1509

Replies from the following companies were not received in time for alphabetizing above.

	Booth Numbers
Douglas Aircraft Co., Inc., 3300 Ocean Park Blvd., Santa Monica, Calif. *(Exhibit planned around Air-Comb Division.)*	1417
Fasson Products Div., Avery Adhesive Products, Inc., 250 Chester St., Painesville, Ohio	1560
(Display of applications for several recently-introduced pressure-sensitive materials, with actual demonstrations including a variety of metallic finishes, textured surfaces, multi-colored printed instructions, identification and promotional decalcomanias and other protective and decorative functions; Mylar-vinyl laminates, self-adhesive Teslar PVC film and self-adhesive polyethylene tape. New—self-adhesive protective paper for easy application and clean removal.)	
Application Engineering Corp., 3811 Podlin Drive, Franklin Park, Ill. *(Multitem Model AC-5 air cooled water-chilling unit, and variety of photo exhibits on company's water chillers and water-saving devices.)*	113
Acme Machinery & Mfg. Co., Inc., 20 South Broadway, Yonkers, N. Y.	604
Allied Chemical Corp., 40 Rector St., New York 6, N. Y.	1041
American Ornapress Corp., 25/27 Gerechtigkeits Gasse, Zurich, Switzerland	1624
Ankerwerck International, Krauss-Maffei International, 2 Hamilton St., Bound Brook, N. J.	1409
Antares Instruments, Inc., 55-02 - 37th Ave., Woodside 77, N. Y.	1554
Automatic Process Control, Inc., 1123 Morris St., Union, N. J.	1573
B.I.P. Engineering Ltd. (Represented by Ralph B. Simons Assoc., Inc., 3517 Main Rd., Tiverton, R. I.)	805
Battelle Memorial Institute, 505 Kings Ave., Columbus 1, Ohio	1628
Bekum, Messrs.	1543
Brabender Corp., Rochelle Park, N. J.	1544
W. H. Brady Co., 727 W. Glendale Ave., Milwaukee 9, Wisc.	401
The Buhler Corp., 4207 Nicollet Ave., Minneapolis 9, Minn.	1506
"Canadian Plastics" Magazine, 341 Church St., Toronto, Ont., Canada.	1304
Cast Optics Corp., 123 Newman St., Hackensack, N. J.	224
Cerro Sales Corp., 300 Park Ave., New York 22, N. Y.	738
Chanal Plastics Corp., 63-20 Austin St., Rego Park 74, N. Y. *(Exhibit of vacuum-formed and blow-molded thermoplastic items.)*	734
Chemore Corp., 2 Broadway, New York 4, N. Y. (See Novamont Corp.)	1241
Cimastra Div., Cincinnati Milling Machine Co., 4701 Marburg Ave., Cincinnati 9, Ohio	840
Cosmos Electronic Machine Corp., 656 Broadway, New York 12, N. Y.	135
Danish Plastics Ltd. (Blow-O-Matic, Ltd.), Aarhusgade 88, Copenhagen, Denmark	1533
Joseph Davis Plastics Co., 430 Schuyler Ave., Arlington, N. J.	418
Davis-Standard Div., Franklin Research & Development Corp.	1428
DeWalt, Inc., Lancaster, Pa.	216
The Dow Chemical Co., Midland, Mich.	933
Eastman Chemical Products, Inc., Plastics Div., 260 Madison Ave., New York 16, N. Y.	1105
Enjay Chemical Co., Inc., 15 West 51st St., New York 19, N. Y.	804
The Exact Weight Scale Co., 538 East Town St., Columbus 15, Ohio	129
Expandex Corp., Wauregan, Conn.	1563
Famco, Inc., Div. of American Air Filter Co., 6300 Strawberry Lane, Louisville, Ky.	1150
Fen-Thread Machine Co., 1910 N. Marshall St., Philadelphia 32, Pa.	109
Fiberite Corp., 516 West 4th St., Winona, Minn.	435
Foremost Machine Builders, Inc., 83 Dorsa Ave., Livingston, N. J.	225
General American Transportation Corp., Plastics Div., 135 LaSalle St., Chicago 90, Ill.	1008
Georgia Kaolin Co., 433 N. Broad St., Elizabeth 3, N. J.	1306
Glass Laboratories, Inc., 863 - 65th St., Brooklyn 20, N. Y.	208
Glenn Electric Heater Corp., 382 Jeliff Ave., Newark 8, N. J.	231
Goodyear Aircraft Corp., 1229 Massillon Rd., Akron 15, Ohio	1212
Olympo Stampi-S.P.A. (Represented by Ernest Gottschalk Co., Inc., 401 Broadway, New York 13, N. Y.)	205
International Ultrasonics, Inc., 331 Centennial Ave., Cranford, N. J.	424
"The Journal of Commerce," 80 Varick St., New York 13, N. Y.	115
Lake Publishing Corp., P.O. Box 270, 311 E. Park Ave., Libertyville, Ill.	1611
Logan Hydraulics, Inc., Sub. of Logan Engineering Co., 4901 W. Lawrence Ave., Chicago 30, Ill.	1433
The Macromal Corp., 153 Prospect St., Passaic, N. J.	909
Markem Machine Co., 150 Congress St., Keene 20, N. H.	1051
"Materials in Design Engineering," 430 Park Ave., New York 22, N. Y.	1131
Mayflower Electronic Devices, Inc., 20 Industrial Ave., Little Ferry, N. J.	406
The Mearl Corp., 41 E. 42nd St., New York 17, N. Y.	213
Metal & Thermit Corp., 100 Park Ave., New York 17, N. Y.	1517
Midland Die & Engraving Co., 502 Factory Rd., Addison, N. J.	1550
"Modern Plastics," 575 Madison Ave., New York 22, N. Y.	1012
Molded Fiber Glass Co., 4401 Benefit Ave., Ashtabula, Ohio	800
New Hermes Engraving Machine Corp., 154 W. 14th St., New York 11, N. Y.	204
Owens-Corning Fiberglas Corp., Reinforced Plastic Div., 717 Fifth Ave., New York 22, N. Y.	925
Pallmann Pulverizers Co., Inc., 315 Newark St., Hoboken, N. J.	1722
Parsons Corp., Special Products Div., P.O. Box 112, Traverse City, Mich.	127
Pennsalt Chemicals Corp., 3 Penn Center, Philadelphia 2, Pa.	1341
Phelps Mfg. Div., Heli-Coil Corp., Shelter Rock Lane, Danbury, Conn.	1310
Phillips Chemical Co., Adams Bldg., Bartlesville, Okla.	104
Plastic Materials & Polymers, Inc., New South Rd., Hicksville, N. Y.	223
Celanese Plastics Co., Div. of Celanese Corp. of America, 180 Madison Ave., New York 16, N. Y. *(Display of typical applications for the company's cellulosics, Fortiflex R polyethylene, Celcon acetal, and Marco polyester resins. Raffling off an 8-foot dinghy made from polyester resins.)*	1117
National Cleveland Corp., 401 Bishop Ave., Bridgeport 6, Conn. *(Three Meter Masterblow Molding machines—Models 167-D, 169-B, and 209-D.)*	1429
Mokon Div., Protective Closures Co., Inc., 2207 Elmwood Ave., Buffalo 23, N. Y.	500
Polymer Machinery Corp., 1229 E. Wakeham Ave., Santa Ana, Calif.	1405

Classified List of Exhibits

ABS Resins

	Booth Numbers
B. F. Goodrich Chemical Co.	1025
Marbon Chemical Div., Borg-Warner Corp.	1605

Acetal Resins

	Booth Numbers
Celanese Plastics Co. Div. of Celanese Corp. of America	1117
E. I. du Pont de Nemours & Co., Polychemicals Dept.	1104

Acrylics

	Booth Numbers
Catalin Corp. of America	1017
E. I. du Pont de Nemours & Co., Inc.	1104
Rohm & Haas Co.	928
Sartomer Resins, Inc.	1542

Acrylonitrile Resins

	Booth Numbers
Fiberfil, Inc.	1518

Antioxidants & U-V Light-Absorbers

	Booth Numbers
American Cyanamid Co., Organic Chemicals Div.	414
Catalin Corp. of America	1017
Geigy Industrial Chemicals Div.	817
General Aniline & Film Corp.	1053

Anti-Static Agents & Destaticizors

	Booth Numbers
American Cyanamid Co.— Organic Chemicals Div.	414

Bactericides & Fungicides

	Booth Numbers
Geigy Industrial Chemicals Div.	817
Santized Sales Co. of America	1328

Bins & Containers

	Booth Numbers
Tote System, Inc.	1329

Blenders

	Booth Numbers
Acme Machinery & Mfg. Co., Inc.	604
Falcon Mfg. Div., The First Machinery Corp.	919
Charles Ross & Son Co.	1555
U. S. Stoneware Co.	1610

Blow Molding Machines

Booth Numbers

Acme Machinery & Mfg. Co., Inc. 604
Danish Plastics, Ltd. 1533
Kautex Machines, Inc. 1537
Moslo Machinery Co. 138
National Cleveland Corp. 1429
Prodex Corp. 1001
Producto Machine Co., Plastics Machinery Div. 1501
F. J. Stokes Corp. 227
Off-A-Triulzi, S. A. S. 1623
Waldron-Hartig Div., Midland-Ross Corp. 811

Catalysts

Berton Plastics, Inc. 835
E. I. du Pont de Nemours & Co., Inc., Electrochemicals Dept. 1018
Metal & Thermit Corp. 1517
Nuodex Products Co. 615
Reichhold Chemicals, Inc. 522
Wallace & Tiernan, Inc., Lucidol Div. 125

Calenders

Reliable Rubber & Plastics Machinery Co., Inc. 636

Casting Equipment

Modern Plastic Machinery Corp. 120

Cellulosics

Celanese Plastics Co., Div. of Celanese Corp. of America 1117
The Dow Chemical Co. 933
Eastman Chemical Products, Inc., Plastics Div. 1105
E. I. du Pont de Nemours & Co., Inc., Electrochemicals Dept. 1018
Enjay Chemical Co., Inc. 804
Union Carbide Chemicals Co. 929

Coated Fabrics

U. S. Rubber Co. 1004

Coating Equipment

Finish Engineering Co., Inc. 616
Zimmer Plastic Maschinen-Gesellscharft Gmbh. 1509

Coatings

Bee Chemical Co., Logo Div. 416
Cerro Sales Corp. 738

Colorants

Claremont Pigment Dispersion Corp. 309
Ferro Corp., Color Div. 421
General Aniline & Film Corp. 1053
Hercules Powder Co. 1129
Interchamical Corp. 622
H. Kohnstamm & Co., Inc. 408
Lawter Chemicals, Inc. 1305
Plastic Molders Supply Co., Inc. 901

Controllers, Temperature

Barber-Colman Co., Wheelco Industrial Instruments Div. 1235
Industrial Mfg. Corp. 1231
The Rainville Co., Inc. 121
Sterling, Inc. 920
West Instrument Corp. 1332

Controls, Electric & Magnetic

The Arrow-Hart & Hegeman Electric Co. 610

Conveyors

Whitlock Associates, Inc. 1422

Cutters

DeWalt, Inc. 216
Foster & Allen, Inc. 425
Herman Schwabe, Inc. 847

Deflashing Equipment

Injection Molders Supply Co., Inc. 1420
Wheelabrator Corp. 635

Diallyl Phathalates

Food Machinery & Chemical Corp. 1404
Mesa Plastics Co. 722

Dispensing Units, Metering, Mixing &

Booth Numbers

Automatic Process Control, Inc. 1513
Hull Corp. 631
Mitchell Specialty Div., Novo Industrial Corp. 825

Drying Equipment

Ball & Jewell, Inc. 816
The Rainville Co., Inc. 121
Thoreson-McCosh, Inc. 131
Whitlock Associates, Inc. 1422

Embossing Equipment

Lembo Machine Works, Inc. 1529

Engraving

New Hermes Engraving Machine Corp. 204
Roll-Die Mold Decorators, Inc. 1338

Epoxies

Ciba Products Corp. 738
Food Machinery & Chemical Corp. 1404
Jones-Dabney Co. 410
Mesa Plastics Co. 722
Reichhold Chemicals, Inc. 522
Shell Chemical Corp. 516
Union Carbide Plastics Co. 929
United States Gypsum Co. 1350

Extruders

Acme Machinery & Mfg. Co., Inc. 604
The Black-Clawson Co., Hale & Kullgren Plastics Dept., Dilts Div. 1347
Davis-Standard Div., Franklin Research & Devel. Corp. 1428
Frank W. Egan & Co. 336
Killion Tool & Mfg. Co. 1622
Modern Plastic Machinery Corp. 120
National Rubber Machinery Co. 221
Prodex Corp. 1001
Reifenhauser U. S. Sales Corp. 1205
John Royale & Sons 1712
Sterling Extruder Corp. 826
Waldron-Hartig Div., Midland-Ross Corp. 811
Welding Engineers, Inc. 230

Extruder Accessories

Industrial Research Labs., Dir. of Honolulu Oil Corp. 949
National Rubber Machinery Co. 221
The Rainville Co., Inc. 427
John Royle & Sons 1712
Off-A-Triulzi S. A. S. 1623
Waldron-Hartig Div., Midland-Ross Corp. 811

Extruded Products

Glass Laboratories, Inc. 208

Extruder Take-Offs

Farris Universal Machine Corp. 730
John Royle & Sons 1712
Waldron-Hartig Div., Midland-Ross Corp. 811

Fabricated Shapes, Sheets, etc.

Berton Plastics, Inc. 835
Cast Optics Corp. 224
Crystal-X Corp. 429
Dura Plastics of N. Y., Inc. 301
The Polycast Corp. 1148
The Polymer Corp. 1050
Printloid, Inc. 831
Raritan Plastics Corp. 1614
Regal Plastic Co. 924
Robeco Chemicals, Inc. 303
U. S. Rubber Co. 1004

Feeders, Weigh

The Exact Weight Scale Co. 1291

Fillers

Georgia Koalin Co. 1306
National Lead Co. 335

Film & Sheeting

American Renolit Corp. 1545
Celanese Plastics Co., Div. of Celanese Corp. of America 1117
Crystal-X Corp. 429
Joseph Davis Plastics Co. 418
E. I. du Pont de Nemours & Co., Inc., Films Dept. 1024
Eastman Chemical Products, Inc., Plastics Div. 1105
J. P. Frank Chemical & Plastics Corp. 1634
Koppers Co., Inc. 535
Monsanto Chemical Co. 1215,1315

Flame Retardants

Booth Numbers

Nixon-Baldwin Chemicals, Inc. 407
Robeco Chemicals, Inc. 303
Union Carbide Plastics Co. 929
U. S. Rubber Co. 1004

Metal & Thermit Corp. 1517
Monsanto Chemical Co. 1215,1315

Fluorescents

Radiant Color Co. 123
Switzer Brothers, Inc. 918

Fluorocarbons

E. I. du Pont de Nemours & Co., Inc', Polychemicals Dept. 1104
Minnesota Mining & Mfg. Co. 1438,1626

Glass Reinforcements

Ferro Corp., Fiber Glass Div. 421
Owens-Corning Fiberglas Corp. 925
Pittsburgh Plate Glass Co., Fiber Glass Div. 1203
Reichhold Chemicals, Inc. 522

Granulators & Grinders

Acme Machinery & Mfg. Co., Inc. 604
Alsteele Engineering Works, Inc. 130
Ball & Jewell, Inc. 816
Cumberland Engineering Co., Inc. 1100
Injection Molders Supply Co., Inc. 1420
Pallmann Pulverizers Co., Inc. 1722
Thoreson-McCosh, Inc. 131
U. S. Stoneware Co. 1610
The Van Dorn Iron Works Co. 625

Heaters & Preheaters

Girdler Process Equipment Div., Chemetron Corp. 1325
Glenn Electric Heater Corp. 231
W. T. LaRose & Associates, Inc. 428
Thermel, Inc. 422
Edwin L. Wiegand Co. 536

Injection Machines

Acme Machinery & Mfg. Co., Inc. 604
Ankerwerck International—Krauss Maffei International 1409
Battenfeld Corp. of America 1528
Conapac Corp. 1414
The Fellows Gear Shaper Co., Inc. 619
Husky Mfg. & Tool Works, Ltd. 1738
The Hydraulic Press Mfg. Co., Div. of Koehring Co. 320
Improved Machinery, Inc. 505
Lester Phoenix, Inc. 1224
Lombard Governor Corp. 1637
Moslo Machinery Co. 138
Newbury Industries, Inc. 737
Progressive Tool & Die Co. 1724
Reed-Prentice Div., Package Machinery Co. 721
Standard Tool Co. 105
F. J. Stokes Corp. 227
Off-A-Triulzi S. A. S. 1623
The Van Dorn Iron Works Co. 625
Watson-Stillman Press Div., Farrel-Birmingham Co., Inc. 521

Injection Machine Auxiliaries

Injection Molders Supply Co., Inc. 1420
Waldron-Hartig Div., Midland-Ross Corp. 811

Inks

The Acromark Co. 913
J. P. Frank Chemical & Plastic Corp. 1634
Interchemical Corp. 622

Labels

Avery Label Co. 210

Laminating Equipment

Lembo Machine Works, Inc. 1529
Poloron Products, Inc. 1251
Raritan Plastics Corp. 1614

Loaders

Foremost Machine Builders, Inc. 225
Injection Molders Supply Co., Inc. 1420
The Rainville Co., Inc. 427
Thoreson-McCosh, Inc. 131

Lubricants

Union Carbide Chemicals Co. 929

Marking

	Booth Numbers
A & S Electronic Die Corp.	235
The Acromark Co.	913
Apex Machine Co.	1301
Avery Label Co.	210
Kensol-Olsenmark, Inc.	1321
Markem Machine Co.	1051
Peerless Roll Leaf Co.	833
Thermo-Dielectric Machine Co., Inc.	1331

Melamines

Allied Chemical Corp.	1041
American Cyanamid Co., Plastics & Resins Div.	1141
Catalin Corp. of America	1017
Fiberlite Corp.	435
Plastics Engineering Co.	329

Metallizing Equipment

F. J. Stokes Corp.	227

Metallized Products

Coating Products, Inc.	504
Glass Laboratories, Inc.	208
Premier Vacuum Process Corp.	600
Robeco Chemicals, Inc.	303

Mills

Reliable Rubber & Plastics Machinery Co., Inc.	636

Mixing Equipment

Baker Perkins, Inc.	321
Prodex Corp.	1001
Charles Ross & Son Co.	1555
U. S. Stoneware Co.	1610

Molding, Extrusion

General American Transportation Corp.	1008
Glamorgan Pipe & Foundry Co.	1633
E. B. Kingman Co., Inc.	404
World Plastics	911

Molding, Reinforced Plastics

Cimastra Div., Cinn. Milling Machine Co.	840
Douglas Aircraft Co., Inc.	1417
Molded Fiberglass Corp.	800
General American Transportation Corp.	1008
Hercules Powder Co.	1129
Johns-Manville Sales Corp.	834
Warminster Fiberglass Co.	300

Molding, Thermoplastic

General American Transportation Corp.	1008
Gries Reproducer Corp.	1549
Hermsdorf Industries, Inc.	1546
E. B. Kingman Co., Inc.	401-4
Snia Viscosa	1525

Molding, Thermoset

Berton Plastics, Inc.	835
General American Transportation Corp.	1008

Molds & Moldmaking

Detroit Mold Engineering Co.	1442
Midland Die & Engraving Co.	1550
Newark Die Co., Inc.	634
Standard Tool Co.	201
Stokes-Trenton, Inc.	1336
J. G. Tilp, Inc.	917

Nylons (Polyamides)

Allied Chemical Corp.	1041
Belding Corticelli Industries	215
Catalin Corp. of America	1017
E. I. du Pont de Nemours & Co., Inc., Polychemicals Dept.	1104
Fiberfil, Inc.	1518
Firestone Plastics Co.	1009
Foster Grant Co., Inc.	1434
Nypel Corp.	206
The Polymer Corp.	1050
Spencer Chemical Co.	413

Ovens

Acme Machinery & Mfg. Co., Inc.	604

Painting Equipment

Conforming Matrix Corp.	1200
Finish Engineering Co., Inc.	616

Papers

Fitchburg Paper Co.	614
Hurlbut Paper Co.	508
Paterson Parchment Paper Co.	1612

Pearlescents

The Mearl Corp.	213

Pelletizers

Alsteele Engraving Works, Inc.	130
Ball & Jewell, Inc.	816
Cumberland Engraving Co., Inc.	1100

Phenolics

Allied Chemical Corp.	1041
Catalin Corp. of America	1017
Fiberite Corp.	435
General Electric Co., Chemical Materials Dept.	1116
Hooker Chemical Corp., Durez Plastic Div.	305
Plastics Engineering Co.	329
Reichhold Chemicals, Inc.	522
Union Carbide Plastics Co.	929

Plasticizers

Argus Chemical Corp.	1704
Eastman Chemical Products, Inc., Plastics Div.	1105
Emergy Industries, Inc.	731
Food Machinery & Chemical Corp.	1404
J. P. Frank Chemical & Plastic Corp.	1634
Hercules Powder Co.	1129
Monsanto Chemical Co.	1215,1315
Pittsburgh Chemical Co.	220
Reichhold Chemicals, Inc.	522
Rohm & Haas Co.	928
Union Carbide Chemicals Co.	929
Wallace & Tiernan, Inc., Harchem Div.	125

Polycarbonates

Fiberfil, Inc.	1518
General Electric Co., Chemical Materials Dept.	1116
Mobay Chemical Co.	1333

Polyesters

Allied Chemical Corp.	1041
American Cyanamid Co., Plastics & Resins Div.	1141
Berton Plastics, Inc.	835
Celanese Plastics Co., Div. of Celanese Corp. of America	1117
Hooker Chemical Corp., Durez Plastics Div.	305
Interchemical Corp.	622
Reichhold Chemicals, Inc.	522
Rohm & Haas Co.	928

Polyethers

Hercules Powder Co.	1129

Polyethylenes

Allied Chemical Corp.	1041
Catalin Corp. of America	1017
Celanese Plastics Co., Div. of Clanese Corp. of America	1117
The Dow Chemical Co.	933
E. I. du Pont de Nemours & Co., Inc., Polychemicals Dept.	1104
Eastman Chemical Products, Inc., Plastics Div.	1105
Goodrich-Gulf Chemicals, Inc.	1618
W. R. Grace & Co., Polymer Chemicals Div.	1108
Hercules Powder Co.	1129
Koppers Co., Inc.	535
Monsanto Chemical Co.	1215,1315
Phillips Chemical Co.	104
Porous Plastics, Ltd.	1635
Shell Chemical Corp.	516
Spencer Chemical Co.	413
Union Carbide Plastics Co.	929
U. S. Industrial Chemicals Co.	304

Polypropylenes

AviSun Corp.	1151
Catalin Corp. of America	1017
Firestone Plastics Co.	1009
Hercules Powder Co.	1129
Novamont Corp.	1241
Shell Chemical Corp.	516
Spencer Chemical Co.	413

Polystyrenes & Copolymers

Catalin Corp. of America	1017
The Dow Chemical Co.	933
Fiberfil, Inc.	1518
Foster Grant Co., Inc.	1434
W. R. Grace & Co., Polymer Chemicals Div.	1108
Koppers Co., Inc.	535
Monsanto Chemical Co.	1215,1315
Rexall Chemical Co.	1613
Shell Chemical Corp.	516
Solar Chemical Corp.	1418
Union Carbide Plastics Co.	929

Polyurethanes

Allied Chemical Corp.	1041
B. F. Goodrich Chemical Co.	1025
Hooker Chemical Corp., Durez Plastics Div.	305
Mobay Chemical Co.	1333
Nopco Chemical Co., Plastics Div.	851
Reichhold Chemicals, Inc.	522

Preform Equipment

Aust & Schuttler U. Co.	500
B. I. P. Engineering, Ltd.	805
Girdler Process Equip. Div., Chemetron Corp.	1325
Logan Hydraulics, Inc.	1433

Presses, Compression

B. I. P. Engineering, Ltd.	805
Dake Corp.	1521
Erie Engine & Mfg. Co.	802
Hull Corp.	631
F. J. Stokes Corp.	227
Off-A-Triulzi S. A. S.	1623
Famco, Inc., Div. of American Air Filter Co.	1150
The Rainville Co., Inc.	121
Thermo-Dielectric Machine Co., Inc.	1331

Presses, Transfer

B. I. P. Engineering, Ltd.	805
Hull Corp.	631
Logan Hydraulics, Inc.	1433
F. J. Stokes Corp.	227
Off-A-Triulzi S. A. S.	1623

Resin-Spraying Equipment

Aust & Schuttler U. Co.	500

Rolls

Pamarco, Inc.	829
Roehlen Engraving Works, Inc.	1234

Sawing Machines

Hendrick Mfg. Corp.	633
DeWalt, Inc.	216

Sealers & Welder

A & S Electronic Die Corp.	235
Atlas Va-Machine Corp.	1135
Cosmos Electronic Machine Corp.	135
Guild Electronics, Inc.	1250
Mayflower Electronic Devices, Inc.	406
Sealomatic Electronics Corp.	501
Thermatron Div., Willcox & Gibbs	1216
Thermo-Dielectric Machine Co., Inc.	1331
Weldotron Corp.	207

Self-Adhesive

Fasson Products Div., Avery Adhesive Products, Inc.	1560

Shears

Famco, Inc., Div. of American Air Filter Co.	1150

Slitters, Sheet & Film

Oscar L. Judelshon, Inc.	915

Stabilizers

American Cyanamid Co., Organic Chemicals Div.	414
Argus Chemical Corp.	1704
Ferro Corp., Chemical Div.	421
J. P. Frank Chemical & Plastic Corp.	1634
Metal & Thermit Corp.	1517
National Lead Co.	335
Nuodex Products Co.	615
Reichhold Chemicals, Inc.	522

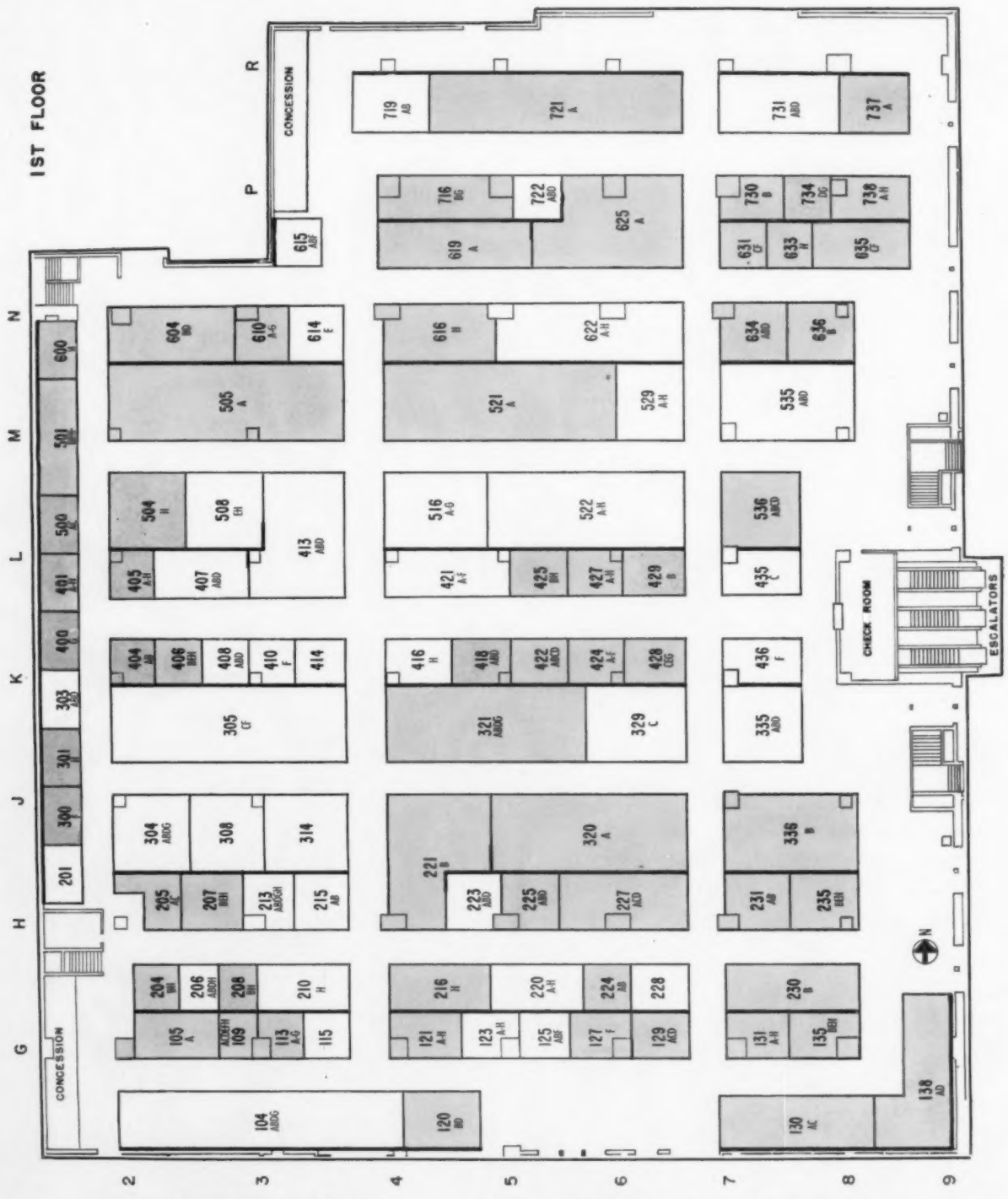
Static Eliminators

The Simco Co.	905

Testing Equipment

C. W. Brabender Instruments, Inc.	1229
Custom Scientific Instruments, Inc.	916
Davidson & Hemmendinger	1317
Instron Engineering Corp.	810
Instrument Development Labs., Inc.	1621

(Continued on page 73)

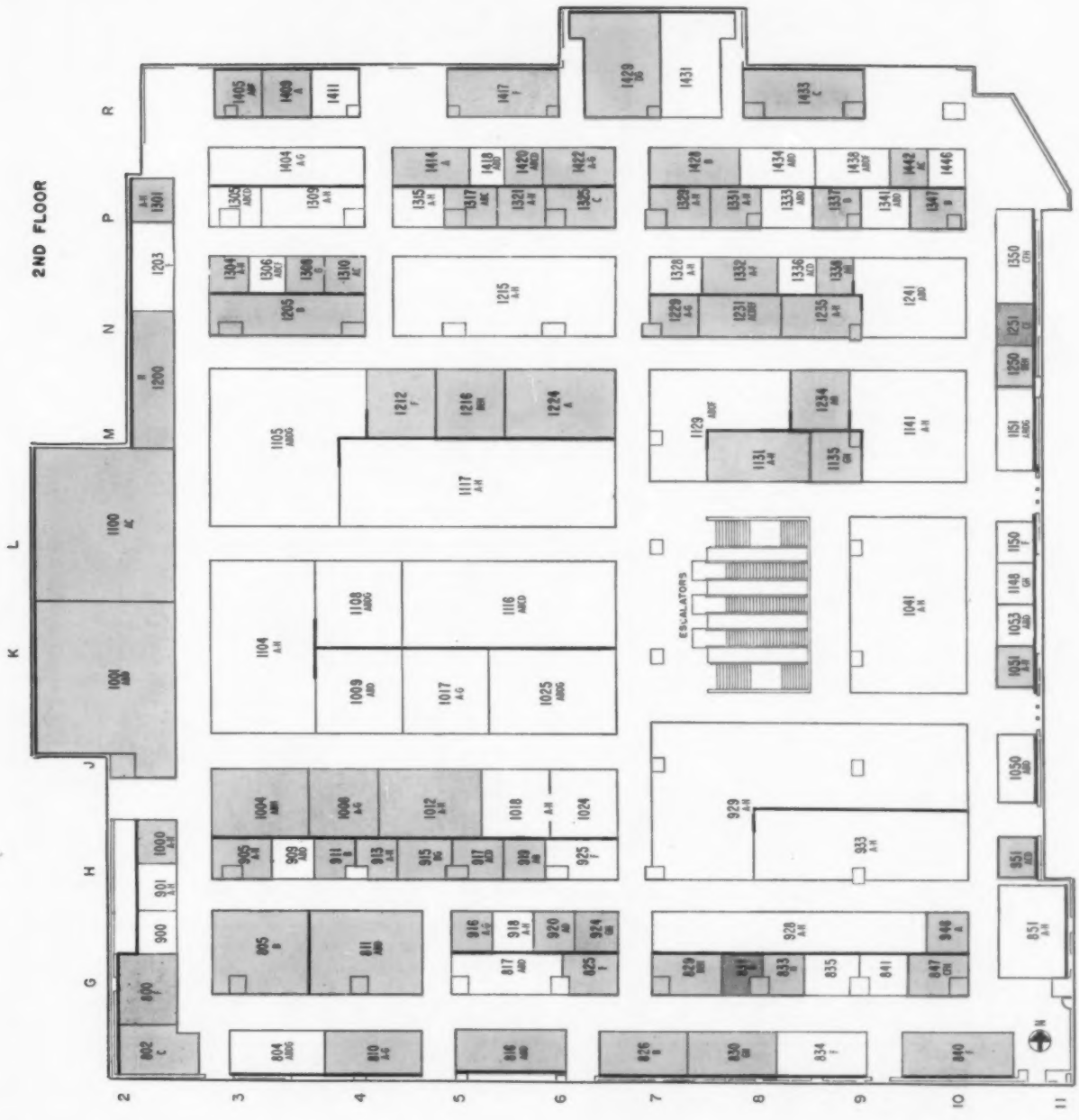


Material Supplier

Machinery Supplier

Processor & Other

A - Injection molding
B - Extrusion & Calendering
C - Compression & Transfer molding
D - Blow molding
E - Laminating
F - Reinforced Plastics molding
G - Thermoforming
H - Decorating & Finishing
I - Received too late to classify.



(Continued from page 71)

Thermoformed Products

Comet Industries, Inc. 1308
General American Transportation Corp. 1008
Hermsdorf Industries, Inc. 1546
Regal Plastic Co. 924
Universal Unlimited, Inc. 400

Thermoforming Machines

Atlas Vac-Machine Corp. 1135
Comet Industries, Inc. 1308
National Cleveland Corp. 1429
Packaging Industries, Ltd., Inc. 1559
Plast-O-Craft Co., Inc. 1734
Producto Machine Co., Plastics Machinery Div. 1501
Tronomatic Machine Mfg. Corp. 830
Off-A-Triulzi S. A. S. 1623

Thickness Controls

Industrial Nucleonics Corp. 716

Tumbling Equipment

Ball & Jewell, Inc. 816
Injection Molders Supply Co., Inc. 1420
U. S. Stoneware Co. 1610

Ureas

Allied Chemical Corp. 1041
American Cyanamid Co., Plastics & Resins Div. 1141
Catalin Corp. of America 1017

Vibrating Equipment

Martin Engineering Co. 1726

Vinyls & Copolymers

Cary Chemicals, Inc. 719
Diamond Alkali Co. 1606
The Dow Chemical Co. 933
Firestone Plastics Co. 1009
J. P. Frank Chemical & Plastics Corp. 1634
B. F. Goodrich Chemical Co. 1025
Monsanto Chemical Co. 1215,1315
Union Carbide Plastics Co. 929

Vinylidenes & Copolymers

The Dow Chemical Co. 933
Pennsalt Chemicals Corp. 1341

Water-Chilling Equipment

Acme Machinery & Mfg. Co., Inc. 604
Application Engineering Corp. 113
Sterling, Inc. 920

Web Processing Equipment

David H. Rosenstock 1337

See floor plan key on page 72

1961 SPI conference program

The SPI Conference portion of Plastics Week, concurrently with the 1961 National Plastics Exposition, will be held in the Hotel Commodore, New York City, on June 6-8. The Conference will be the largest ever planned by the plastics industry, and will consist of daily morning sessions and panel discussions by authoritative speakers interpreting and analyzing current industry events and future trends. Each session will end with a question-and-answer discussion.

Registration charges for the Conference will be $30.00 to SPI member company individuals, and $35.00 to non-members. These charges include registration fees to the National Plastics Exposition, the Industry Reception on June 6, the luncheon on June 7, and the International Reception on June 7. Registration tickets to the Exposition will not cover the Conference.

Tuesday, June 6

There will be four concurrent sessions from 9:00 to 12:00 noon.

The session on "Plastics in Building" will be held in the Grand Ballroom and be divided into two sections; I. Plastics Applications, moderated by W. H. Scheick, American Institute of Architects, and II. Codes, moderated by Frank Ambrose, Alsynite Div. of Reichhold Chemicals, Inc. Section I will consist of:

"Architectural Needs and Applications for Plastics, Including Existing Applications and Future Needs," G. E. Danforth, Illinois Institute of Technology.

"Builder Looks at Plastics," G. P. Dorrance, Turner Construction Co.

"Time and Use vs. Plastics," W. A. Cleneay, Architect.

"Plastics' Role in Lighting," K. M. Reid, Illuminating Engineering Society.

Section II will be composed of:

"Problems and Opportunities in the Building Codes," F. J. Rarig, Rohm & Haas Co.

"Codes at the Local Level," Leo Goldstein, City of Philadelphia.

The second session, on "Plastics in Communications," will be held in the East Ballroom, be moderated by J. V. McBride, The Plastic Wire & Cable Corp., and will consist of the following:

"Plastics in the Recording Arts," C. J. Martin, Radio Corp. of America.

"Plastic vs. the Elements in Telephone Communications," J. B. DeCoste, Bell Telephone Laboratories, Inc.

"Plastics in the Space Environment," Eric Linden, Fort Monmouth Civilian Signal Communications Laboratories.

The third session, "Plastics in Machinery," will be held in the West Ballroom, be moderated by A. J. deMatteo, Consultant, and be comprised of:

"New Developments in Machinery for the Thermoforming Industries," W. C. Schlager, U. S. Rubber Co.

"New Developments in Blow Molding Machines," R. Boyden, F. J. Stokes Corp.

"New Developments in Injection Molding Machines," J. W. Hendry, Marbon Chemical Div., Borg Warner Corp.

"New Developments in Extruders," A. A. Kaufman, Prodex Corp.

The fourth session, by the SPI Thermoplastic Structures Division on the theme, "The Uses and Techniques for Fabrication of Rigid Thermoplastic Structures," will be held in the Windsor Ballroom, be moderated by Paul Chamberlain, Industrial Plastic Fabricators, Inc., and Chairman of the SPI Division, and will consist of:

"Uses of Polyolefins in Thermoplastic Structures," speaker to be designated.

Color Movie, "The Manufacture and Fabrication of Polyolefins in Europe," courtesy of Hoechst Co.

"Welding, Heat Sealing, and Cementing Techniques Used in the Manufacture of Thermoplastic Structures," Donald Wolff, Plastics Div., Seiberling Rubber Co.

"Fabrication of Plastics for Corrosion Control," A. B. del'Etoile, Delbrook Engineering, Inc.

At 6:00-8:00 P.M., there will be an Industry Reception.

Wednesday, June 7

The 9:00 A. M. to 12:00 noon program will also consist of four concurrent sessions, as follows:

The session on "Plastics in Packaging," will be held in the Grand Ballroom, have the theme of "Plastics for Profits," be moderated by Lloyd Stouffer, *Modern Packaging*, and be comprised of:

"Present and Future Penetration of Plastic Packaging in 14 Major Markets," Donald Mahaney, Monsanto Chemical Co.

"Flexible Plastic Packaging Flms," F. E. Long, Continental Can Co.

"Plastic Bottles, Tubes and Other Merchandising Packages," A. J. Sanders, Colgate-Palmolive Co.

"Rigid Plastic Nestable Containers," F. N. Hartmann, Lily-Tulip Cup Corp.

The second session, "Plastics in Automotive," will be held in the East Ballroom, be moderated by Hartley Barclay, *"Automotive Industries,"* and consist of:

"Current Uses and Requirements," T. H. Risk, Ford Motor Co.

"The Purchasing Agent Looks at Plastics," Jack Moran, Chrysler Corp.

"The Role of the Processor," J. J. O'Connell, Consolidated Molded Products Corp.

"Looking to the Future," M. F. Garwood, Chrysler Corp.

Panel discussion with questions and answers by John Young, E. I. du Pont de Nemours & Co., Inc.; John Slater, Eastman Chemical Products, Inc.; Jack Doyle, Rohm & Haas Co.; and Harry McGowen, Union Carbide Plastics Co.

The third session, by the SPI Vinyl Dispersions Division, will be held in the Windsor Ballroom, be moderated by F. W. Caplan, Reynolds Chemical Products Co., and consist of:

"General Introduction to Vinyl Dispersions," D. R. Meserve, Metal & Thermit Corp.

"Uses of Vinyl Dispersions—Present and Future," R. T. Hanson, Flexible Products Co.

"Role of Custom Formulator in the Vinyl Dispersions Industry," R. F. McTigue, The Stanley Chemical Co.

Panel discussion by above speakers, Russel Park, and a representative from the Plasticizer Div. of Monsanto Chemical Co.

The fourth session, by the SPI Epoxy Resin Formulators Division, will be held in the West Ballroom, and have the theme, "Breadth and Scope of Epoxy Applications," be moderated by Donald Roon, Hysel Corp., and consist of the following papers:

"Adhesives," Bernard Gould, Rubber & Asbestos Corp.

"Electrical," John Delmonte, Furane Plastics, Inc.

"Tooling," Charles Douglas, Mirolette Corp.

"New Applications," Cecil Armstrong, Armstrong Products Co.

From 12:30-2:30 P.M., there will be a luncheon in the Grand Ballroom, with principal speaker to be Leo Cherne, Exec. Director, Research Inst. of America, Inc., on the subject, "A Time of Trial."

From 6:00-8:00 P.M., there will be an International Reception, to be held at United Nations Headquarters.

Thursday, June 8

There will be three concurrent sessions from 9:00 to 12:00 noon.

The first session, "Plastics in Appliances," will be held in the Grand Ballroom, be moderated by G. B. Thayer, Dow Chemical Co., and consist of:

"Market Goals for Appliances," Harvey Weimer, Whirlpool Corp.

"Designing Appliances for Functional Performance," C. W. Sundberg, Sundberg & Ferar.

"What the Appliance Industry Feels it Needs in the Way of Plastics Materials and Services," William Gobeille, Kelvinator Div., American Motors Corp.

"The Bissell Shampomaster — A Case History," P. J. King, Bissell, Inc.

The second session, "Plastics in Defense," will be held in the East Ballroom, be moderated by J. K. Honish, Union Carbide Plastics Co., and consist of:

"Plastics in Weapons," Dr. Albert Lightbody, U. S. Naval Ordnance Laboratory.

"Plastics in Over-All Defense," Paul Forsythe, OSD-DDR & E.

"Plastics in Ship Construction," William Graner, Navy Bureau of Ships.

"Plastics in Space & Missiles," V. N. Saffire, Missile & Space Vehicle Div., General Electric Co.

The third session, by the SPI Cellular Plastics Division, will be held in the West Ballroom, have the theme, "Plastic Foams — At Home — At Work — At Play," be moderated by Edwin Edberg, Kopper Co., Inc., and Vice Chairman of the SPI Division, and will consist of:

"Plastic Foams in Furniture," R. C. Roe, Schmadig Corp.

"Plastic Foams in Construction," speaker to be announced.

"Plastic Foams in Transportation," James Leonard, Lique Freeze, Inc.

"Plastic Foams in Defense," Mario Gigliotto, General Electric Co.

"Plastic Foams in Leisure Activity," speaker to be announced.

A. R. MORSE*

Management problems in injection molding

Standard manufacturing procedures, costs, and controls simply do not apply to injection molding. This makes it especially difficult to operate an injection molding division within a large, diversified company and keep it competitive with the injection molding specialist. This article suggests ways of accomplishing this, and points out pitfalls along the path.—Editor.

Installing an injection department for proprietary molding is a real problem for company management. Likewise, operating a custom injection molding division within a large company presents many unconventional difficulties. This is because injection molding is an offbeat business. Not only is it a relatively new field, but it has made tremendous strides and undergone many more technological changes than most other industrial areas. Some of these amazing developments have been in molding materials, others in specialized machinery, each creating its special problem.

The small, flexible molder has barely been able to keep abreast of all these developments. A large company is at an even greater disadvantage because of the growing reliance on generalized management. Such systems are just not geared for dealing with injection molding, where "exceptions are more common than the rule."

We have heard a great deal about the need for the education of plastic engineers, and something is being done about it. But what about the much more critical need for executive education in the highly specialized field of plastic molding? So far as I know, no one has yet attempted to isolate some of the special situations which have risen in the plastic industry simply because top management does not understand either the language or technology of the molding room. A broad knowledge of the injection industry and its unusual operations is vital, if a corporate management is to attempt profitable injection molding operations on a divisional basis. Even then it's a moot point whether injection divisions can operate at a profit in competition with independent injection molders.

General areas of difference

There are several specific areas where one can profit by the experiences of companies who had or have injection molding divisions. The fact, however, that there have been an abnormally high number of injection molding departments closed down indicates that special problems must exist. I believe, too, that the recent growth of captive molding has complicated our view of molding operations because facts are harder to extract from a more complex industrial picture.

It is my purpose to examine some of these situations and, drawing from my personal observations of the successes and failures of large company molding divisions, to come up with certain basic considerations. It is especially important to note that usual management concepts of typical manufacturing operations like stamping, turning, or metal fabrication and assembly are based on predictable and stable factors. Experience in these fields can seldom, if ever, be successfully applied to an injection molding department.

Conventional procedures, standard costs, and other forms of central control systems seem to break down and give misleading information when they are imposed on an injection department. If "standard procedures" are applied to a molding division, it has never remained competitive. Today, where injection depart-

* Pres. Injection Molders Supply Co., Cleveland, Ohio.

ments are run as part of larger operations, costs of molded articles must be considered secondary to other factors like part quality, dimensional tolerances, or short runs which the ordinary molder would not handle. The exceptions, of course, are at the other end of the scale where the quantities involved are too great, or the equipment needed so specialized that the large company has no alternative but to do its own molding. In either case, top management is all too often short on its understanding of injection molding problems.

Most management difficulties seem to stem from two basic features of the injection process. We are dealing with relatively high heats and high pressures which must be closely coordinated for good results. Even the best management system is hard put to account for the high costs of press downtime, high scrap rates, mold problems, and other unusual losses directly traceable to the special nature of injection molding. Management must not only be aware of competitive factors, but also of the highly specialized problems incident to successful operation of injection molding divisions.

Special consideration must be given equipment selection and plant layout. Specialized cost and control procedures must be devised. Decentralization must proceed to a point where the injection division becomes a virtually independent unit. Equipment obsolescence and ancillary opportunities such as blow molding, vacuum forming, etc. must be kept under constant review. The competitive effect of non-injectable materials such as epoxies and foams must be continuously appraised to avoid costly errors in future planning.

A thorough management awareness of unusual industry conditions caused primarily by internal competitive factors, however, is the first and most important consideration in the operation of an injection molding department. With this in mind, we can then examine some specific advantages which the autonomous molder enjoys, and which no corporate management can afford to overlook without seriously misappraising the actual objectives of its own molding division. First, let us look at some of these unusual internal factors.

Injection machinery is different, and highly specialized. Procurement problems involve comparison of conflicting technical specifications, many of which are contradictory. A special terminology of ratings is used. The buyer must be able to look a great deal deeper into performance than with other types of equipment, or he can be easily misled.

The matter of ratings of injection machines has probably caused more executive problems than any other phase of injection plant planning. Clamp ratings in tonnages are readily understood, and comparison between press clamping figures as stated by press makers are seldom misleading. However, when press clamp is measured by the machine's ability to hold hot plastic inside a mold, two variables enter the picture which are almost never understood at the executive level. First is the matter of overall press rigidity. This includes flexing of platens (whether ribbed or solid) and stretching of tie bars—especially bars with shoulders concealed by nuts or platens. Second is in the amount of injection pressure transmitted to the mold. This varies widely, not only as estimated by engineers, but as actually observed on the machine. Unless one is thoroughly aware of the relative allowances that must be made for them on the various makes of machines, costly errors in equipment selection can occur.

Heater rating

Another problem is press plasticizing capacity. How much will a given machine melt per shot and per hour? The two factors are entirely different, and the truth is especially hard to arrive at. IMS has spent more than a decade trying to resolve contradictions among the various degrees of optimism inherent in the published press ratings, and to eliminate the many causes of heating cylinder failures by basic redesign. That truth can be a precious commodity, we know only too well, having spent more than two years and thousands of dollars in fighting an expensive lawsuit in defense of our freedom to comment frankly on industry problems relating to heating cylinders.

The crux of the matter is simple. Every press maker has a virtual monopoly on components for machines of his own make. Any attempts at standardizing the injection machine have been stubbornly, slyly, or bitterly resisted. While some progress has been made to standardize platen layouts, largely through the efforts of Detroit Mold Engineering Co., it has been little more than a token. A vast discrepancy still exists between molding machines which, according to their stated ratings, should at least do the same jobs equally well. In the molding room, they give radically different results.

It is my opinion that, before the press makers can agree on standard press ratings, our whole industry is going to be upset by the invasion of movable screw injectors. The next five years are going to witness unparalleled turmoil as to which machine will do what jobs and how well. For the executive getting his first taste of plastic molding, the equipment problem is greatly magnified because every "expert" he consults has a different opinion. If he had access to our information, compiled over the years, he would be still more confused. How does one press maker use 7,000 wats and a 2½ inch plunger to get more plasticizing than another using a 2⅝ inch plunger and 11,000 watts?

In our own field of specialization (the heating cylinder), I would suggest two specific areas where the executive looking over press specifications can glean real money saving information. First, I would ask to see a heater actually being mounted and then taken off a press to get an idea of my press downtime when I had cylinder trouble. Secondly, I would try to get a historical record of heater life and repairs from the manufacturer, and then check this against the actual experiences of several users of the given machine.

As a rule of thumb discount the average press makers' ratings about 30-50%. A 16-oz. press which is never used on shots over eight ounces, for example, is not likely to bend platens, break tie bars, split the heating chamber, or tax the plasticizing capacity of the given machine. If you are big enough and rich enough the solution is a good one.

Errors can be costly

Even the largest concerns with specialized equipment

engineers have made drastic errors in selection of injection machines. Today, with screw injectors in countless variations about to come on the market, the chances of making a mistake are greatly multiplied. Big company purchasing power is no protection, and many molding divisions house some real lemons because unbiased injection equipment consultants are few and far between.

In one instance, a young engineer was given a multi-million dollar carte blanche to buy presses. It turned into a real heyday for the equipment people. This attempt to apply ordinary planning procedures (which were successfully used to equip the rest of the plant) to the molding division resulted in the installation of $750,000 worth of machines which to this day have not been put into production successfully! At least a dozen unnecessary machines were bought, some of which were technologically obsolete before installation! In this instance, I had a chance to talk to the president of the company involved, but couldn't even begin to convince him of the points I am trying to make here. From his viewpoint, the molding division was an insignificant detail. Today, however, it is a major stumbling block absorbing tens of thousands of hours of executive time.

Probably nothing, however, can match the instance where a concern ordered four or five new machines. The machinery supplier noted from their own records that 4-5 similar machines delivered over a year before had never been serviced. Their inquiry brought out the fact that the machines had been put into storage and their whereabouts actually forgotten! While this is the exception rather than the rule, it does indicate that even something as big and expensive as injection machines can get lost when responsibility for a molding division is not segregated from the complex problems of overall manufacturing.

I want to emphasize at this point that I am not being critical, but making a plea for plastic department autonomy and decentralization. Let me cite another instance where a large company attempted fully automatic molding on a huge scale. Almost all the machines were custom built, and they were put into production without the 2-3 year running time it normally takes to work out all the bugs. To complicate matters further, all new tooling was required which could not be adapted to conventional machines. Furthermore, built-in nozzles were virtually imbedded in the tool. A simple nozzle change took a whole shift, and nozzle set-up required lapping in many instances, plus a baffling alignment problem.

Aside from tooling problems, and admitting the advantages of soft-mold closing and other expensive built-in safeties (many of which slow the press down), it is interesting to observe the way operators soon begin to "re-appear" in automated plants. When you see "inspectors" stationed at almost every machine, top management is justified in taking a second look at automation costs. I have an informal wager with certain individuals in one particular company that their bold attempt at automation was undertaken fully ten years too soon.

We figured that $2½-million could have been saved if standard machines and tooling had been used in place of special machines and tools. Today, most injection machines are ill suited to real automation because our instrumentation is still relatively crude. Our machinery is barely able to take ordinary production runs let alone the real gaff of high-speed unattended operation. Tooling problems for automatic presses remain a costly stumbling block, mainly because of the high price tag on foolproofing.

Molding design and other related problems must often appear utterly incomprehensible to the executive. Otherwise I do not believe companies would invest in million dollar programs tied to special new molds to be run in special new machines, without the least chance of being able to use these same tools in standard machines in event of a miscalculation along the line. When a good, hard-headed, smaller molding company attempts automation, it is with one machine, or two.

Probably no other area is so full of conflicts today as whether to use a few larger machines with multiple part molds or a large number of smaller "automatic" machines with cheaper one or two cavity molds. There are divergent trends in both directions. From time to time one concept seems to pull ahead of the other, but if pinned down, I would have to vote for the family mold in a larger machine. Cheap foreign-made presses may change this picture, but I still believe bigger American-made machines can give them a good battle.

I think I can sum up the attitude of a good many large companies toward their injection divisions by the remark made to me by the president of one large concern which was liquidating its plastic injection department. At the request of a molder who badly needed a couple of the machines, I visited this executive to explain the situation. Before I could get down to cases, he asked me how much money was involved. I replied about $225,000. And before I knew it, I was being ushered out of his office with the comment, "Don't bother me with details!"

With the growing number of mergers of injection plants into larger companies, communicating the problems of the divisional manager upstairs seems a major block to further growth. Certainly today, the most successful injection departments are those where the department manager has direct access to top management without having to funnel through conventional engineering and control channels, or other general manufacturing departments where his problems are minimized by the overall picture. General Electric's new unit system of management control is one forthright method of dealing with this problem, as it confines specific problems to specific responsible individuals without burdensome inter-departmental red tape in getting decisions made. It is a plan to be watched closely, as it may provide a practical answer to the communication problem.

Two industries which have faced the special problems of injection molding are the glass and shoe manufacturers. One shoe machinery company is coming on the market with an automatic movable-screw injector which shoots into a rotary type mold clamp. Look for other developments as the shoe makers become aware of the costly general-purpose features of an ordinary injection machine. The glass people know it is foolish to pay for platen size and strokes they cannot use. Both industries, however, play their cards close, and the

average injection molder is going to have a hard time finding out how they are solving the equipment problem.

Combatting obsolescence

Thermoplastic molding is a relatively new art and developments in material and machinery have been very rapid. Obsolescence of equipment alone has been the reason for the gradual stagnation of several molding divisions where management neglected to keep abreast of the times. In one instance, a large division had nearly fifty obsolete machines. Molds had grown bigger, and the platens were now too small. The presses had been written off over a conventional and, of course, incorrect twenty-year basis. When it was decided to sell some of the more obsolete machines, a used machinery dealer was called in to make an offer. It was a coincidence that his offer and the company's book value were the same figures except for the placing of a comma and a zero: $5,500 versus $55,000! The presses, of course, are still looking for a buyer, and management is left with a special bookkeeping problem.

The shorter the writeoff period, the more closely your books may reflect the true market value of the injection machine, especially with the advanced screw plasticators now on the horizon. Conventional amortization can lead to fantastic misevaluations of the injection division's potential. Ordinary accounting principles must be revamped to suit the special needs of the injection division.

At the other extreme, older injection machines need not be considered prematurely obsolete. A great deal can be done to restore them to full productivity on modern molding materials. We have specialized in the problem of how to beat obsolescense in older injection machines. In one instance, we saved a company a multi-million dollar investment by extending the useful life of ten of its old molding machines. How did it start? Not at the top, but with one man close to production who believed that if the output of his present machines could be increased, his department could remain competitive.

He gave us a clear picture of the problem. We then laid out an extra capacity heating cylinder for one of the machines involved. This one man was able to enlist the help of three others in engineering, maintenance, and purchasing. We then waited for the facts to percolate upward. This took more than a year! Eventually, we got an order for an improved heater and I was present at the startup and evaluation. As we began to speed up the cycle, it soon became obvious from the reduced heats and improved part quality from degassing that press output was nearly doubled. What a shock I got though when I heard they had to set the cycle back down again. The union complained that the parts were coming through too fast! Our job was done. But in this case, I can report that in-plant education and the reality of competition changed labor's viewpoint.

Financing makes costs vary

The specialization of injection equipment has caught several companies at a disadvantage because, unlike machine tools, the market is limited to a relatively narrow industrial area in which "unusual" terms have been available. The problems involved in equipment financing must be thoroughly understood, because injection machines are expensive—yet prices are highly unstable. A long internal lead time is required for their manufacture. Competition is traditionally keen and manufacturing overheads are highly variable. Some press manufacturers are divisions themselves; others are small shops with a low overhead.

A large part of an injection machine's cost is in purchased, ready-made items like pumps, timers, valves, heater band and instruments. Also, there is a stiff markup for warranty and field service. However, expensive, injection machines are often available on perhaps the easiest terms of any capital equipment today. The models are standardized only on a broad basis, and parts are never interchangeable—in most cases not even between machines of the same make. Some machinery companies will furnish free parts for years after the machines have been in service just to keep their salesman's foot in the door.

The spare parts monopoly each press maker enjoys is a definite factor in press selection, and deserves a closer scrutiny than it usually gets. The cost of "orphans" can mount astonomically, and the delay in getting spare parts is one of those unusual cost factors which are hard to separate out at the executive level. The free part policy, however, remains a large factor in present day injection machine costs.

Competitive advantages are often confined to the faster cycle times available with new models. But injection machines seldom, if ever, operate at top speed because operator facility and set-up time in the mold (cooling rates) are the chief factors determining productive output. Thus, on most jobs, the oldest press can be an effective production tool. Hour charges can be held at a minimum, and maximum attainable speeds can be reached. The premium paid for top machine speeds can seldom be translated into profit dollars, but must instead be looked on as an extra cost factor.

The principal considerations, however, are the wide discrepancy in press costs and subsequent charges. It may be necessary to compete with concerns who are operating injection machines in which they have little or no fixed investment. Whether or not a large company can purchase a press, charge off financing costs arranged according to conventional net terms, and still compete with a concern which has made no capital outlay for or even has a risk in its major productive machinery, remains an unanswered question. The wide variations in machine-hour charges found in the trade certainly reflect both the extensive use of outside capital to finance machinery and the fact that many machines are written off, yet are still fully competitive production-wise.

Material buying problems

Can the big company meet specialized competition?

A large organization doing injection molding must meet intensive specialization on many levels. In material purchasing alone, final cost can be sharply tipped toward profit or loss, and the executive must understand some of the distinctive situations facing the thermoplastics user. Competition is extremely severe among the material suppliers, and will become more

so as new companies enter the business and more powder plants go on stream. Special deals, quantity discounts, delayed billings, and many private arrangements whose details are never divulged give certain concerns clear-cut price advantages over others. The topic is seldom, if ever, discussed in the trade, but basic material costs vary greatly for various molders and are a vital factor in operating an injection plant successfully. A little investigation will show that extended credit and other special considerations such as new product development help, publicity tie-ins, unusual quantity breaks, rewards for exclusive contracts etc., have always been big factors in determining the final cost of molding powder in the thermoplastic material field.

A divisional molding operation should aim at growing large enough to justify manufacture of its own molding powder. Vertical integration is a trend that I expect to grow as the shoe and container industries realize the full impact of thermoplastics on their lines. Such a molder-manufacturer would have a competitive advantage over injection molding specialists who still have to pay the chemical companies a large and continuing profit.

Where vertical integration is not possible, only exclusive contracts, bulk purchases, or other special deals will permit users to obtain the vital price concessions in molding powders. Considerable buying leverage is exercised by the large molders, since the supplier has lower sales costs, less servicing, no costly small-batch formulations, nor tie-ins with national advertising. Off-grade reprocessed molding materials offer opportunities for reducing raw material costs. Caution must be exercised, however, because serious molding problems are sometimes encountered due to inferior batch characteristics. These may more than offset bargain prices. Since equipment and housing costs can be reduced to some comparable basis, the chief variable must always be the cost of molding materials. This determines a molder's competitive status, regardless of his size. Remember one astounding fact: It is not unusual, the way many larger molding plants are operated today, for the cost of their raw pellets per pound to equal the price they would have to pay for their finished products delivered to them already molded by another company!

Outside capital helps

Special deals in both equipment and molding powder purchase have become so entrenched that it is often impossible for top management to know whether it is being victimized or not. Our policy of issuing a fully priced equipment catalog has been very well received by planning and plant engineers. This would indicate that a good deal of confusion could be eliminated if other concerns would also take the wraps off their prices and put an end to "deals."

Some molding companies have been able to operate with a large part of their working capital furnished by material and machinery suppliers. This stems, I believe, from the fact that injection molding has almost always demanded high risk capital. It's taken a lot of real selling to get thermoplastics underway. The original ceramic tile makers, tin bucket makers, china houseware manufacturers, etc., with established market outlets, who might logically have switched to thermoplastic products, have failed to do so.

While large amounts of venture capital have come from various entrepreneurs, the rest was necessarily furnished one way or another by the firms who have developed the molding powders and machinery for the new industry. It is this unusual source of so much venture money that permitted the injection industry's rapid growth, but has given it growing pains as well. Many molding companies received their machinery without more than a token payment and were extended open credit for vast amounts of material—often on the basis of nothing more than an idea. In one instance, a shop obtained some 20 presses on deferred terms and had several hundred thousands of pounds of material inventory when its bubble broke. The machinery and powder people had many sleepless nights before a salvage plan was finally worked out.

Whether or not financing will revert to more conventional patterns remains to be seen. In the meantime, the large company which does not avail itself of all the advantages offered by these unusual trade conditions will remain at a distinct disadvantage.

The time element

The injection industry has grown in well-defined spurts, which have affected the costs of both raw materials and machinery. When machines are plentiful on the ebb cycle, fantastically favorable terms are available. The converse also applies. Many chemical concerns have jumped into the powder field, and supplies often tend to increase faster than demand. Certainly, if a chemical company invests a fortune in a molding material plant, it is going to use the most drastic means to see that its product moves. Countless problems can result, including serious misapplications as well as price cutting on the grounds that certain batches are off-brand. These are things the injection industry has had to take in its stride, not because a material company is ruthless, but by their very nature you produce molding powders on an immense scale or not at all.

Many molding powder problems would be far less complicated, today, if we had been able to expand a pilot plant gradually as the market was developed. For example, let me cite the tired old case of polyvinyldene chloride. This fine material was advertised in the Saturday Evening Post during the middle forties almost before any molder had heard of it. It later developed that iron could not be used in its processing. To this day, only a few pounds are injection molded, yet here is a plastic with an immense potential if cylinders and presses could be built to handle it.

Prodigious efforts are continually made to induce users of other materials to convert to the high-production, newer thermoplastics. We are also in the midst of a tremendous push to sell the end-user. For a year or two, we will be beset by molding problems and misapplications. There will be a reaction against the material, until the molder learns to mold and apply it properly. Executive timing here can literally make or break a molding division.

We have a continuous tug of war between the ma-

terial supplier and press maker. Each has made progress, but in spurts. There has seldom been a time when presses able to mold all the available materials into the sizes and shapes in current demand. Today, we are just on the threshold of producing machines to mold problem materials like rigid PVC, acetals, and polycarbonates.

Big company advantages

Competitive factors in thermoplastic marketing are definitely in favor of the large company with effective national distribution. Severe local competition on specialty items is to be expected, but few injection molding firms can offer a complete product line; nor can they offer ancillary, non-thermoplastic products, or products where thermoplastics is a component, but does not determine the final sales price of the article. There are few injection firms with well-rounded product lines and national distribution.

Freight factors must be thoroughly evaluated. Molded thermoplastics are light but bulky and command premium transportation rates. This gives a definite advantage to concerns located in specific market areas. The problem is so acute that the Society of the Plastics Industry has an active traffic division. Product lines permitting package deals where highly competitive, low margin items can be carried by other more profitable products offers one solution. Another is high volume sales created by consumer demand through national advertising. Few, if any, injection molders can afford this.

Big company handicaps-tooling and accessories

The experienced injection molder has an advantage in mold and tool design. He knows core bending, venting, gating, and water passage layout factors peculiar to injection molding. Many large molding companies have lost both money and jobs through unfamiliarity with designing oversize back-up and support plates for cores.

Mold chilling accentuates the importance of mold water passage design; and competition can force the adoption of machine modifications before a non-specialized company has even heard of them. Delay caused by red tape can cause molding divisions to lag even farther behind. By the time a problem is decided by management, the cost of catching up, of tool revisions, etc., may be prohibitive. It might be more economical to discontinue the division rather than modernize it.

Maintenance—a key zone

In production and production control, certain corporations have standard procedures which work well in the injection department. Scheduling problems, however, like new mold run offs, mold changes, and color changes are unique to the injection industry. Here, the company doing nothing but injection molding has many clear-cut advantages over the large company trying to stretch its production controls over the high down-time factor of the injection press.

One solution to this problem lies in the way maintenance is handled. In injection machine maintenance, many unusual costs can be incurred. The injection machine has grown increasingly complex, requiring experts in both electric and hydraulic circuitry. As presses age, a considerable increase in mechanical problems occur such as cracked castings, galling, and line breakage. Analysis of press trouble must be quick and expert, or downtime costs are excessive. Small companies or injection molding specialists can handle such problems much more quickly than any general maintenance department.

Spare parts and heating cylinder inventory costs are generally held to a minimum in large companies—often a false economy. Only experience indicates the size and scope of parts inventory necessary for minimum downtime.

As specific proof that maintenance is not an insurmountable problem, I can cite more than one large company where a sound preventive maintenance program has kept an injection department operating in spite of the special problems involved. Most difficulties appear when maintenance men have to go through routine engineering, purchasing, and other channels. Left to their own devices, they can hold press downtime to the minimum. A practical foreman with complete authority should be used on each shift. Cutting his autonomy invariably increases downtime. Injection room efficiency rises and falls in direct proportion to the freedom given to its maintenance department.

Mold repair and maintenance are areas where the injection molding specialist has a great advantage. Not only can advance planning reduce mold start-up time, but proper knowledge of mold details, plate sizes, core supports, pressures, etc., can cut costs considerably. Such failures also indicate false economies—cutting high mold costs by slighting strength, purchasing so-called "cheap labor" foreign molds, or hiring tool makers inexperienced with thermoplastic molds. This is especially true when the personnel has had previous experience with rubber, die cast, compression, or stamping dies. Generalizations simply do not apply.

Other cost factors

Accounting procedures for a concern specializing in injection molding are usually quite different from those used in general manufacture, rubber molding, or other industrial areas. Standard costs can seldom be used, because they do not compensate for highly variable tool costs, special machinery, deals, etc., all of which are directly reflected in the price of finished products. Selling at, or near costs to gain a market toehold is often done, and price shading can offset freight factors. A conscious omission of certain costs can lead to errors in pricing, especially when a large company is trying to justify itself in price comparisons with moldings made by other companies.

False reports of competing prices have led to useless investigations into basic cost factors. Machine hour charges vary widely in the injection industry, and it is nearly always possible to obtain a cut rate somewhere. Standard costs indicate only in the most general way what your own price should be. The special kind of accounting needed to establish injection molding costs has been the subject of several studies by Tarnell Company and the Society of Plastics Industry.

Injection molding has traditionally been an area of low profit, with the real money being made by the material supplier and the product merchandiser. Raw material cost control is the one sure way the molder can meet competition. As injection operations grow, their net profit declines. Either injection molding cannot carry the usual overhead, or its growth pattern should be carefully re-examined. Accounting must be geared to reflect only those charges actually incurred by an injection molding division, unless products are reprocessed as assemblies or incorporated into other products. There, the straight price competition of custom and proprietary injection molders cannot be considered a vital factor any longer.

Competitors' prices may also reflect fluctuating capacity factors. When press capacity is suddenly available for whatever reason, such low rates are quoted that ordinary competition can rarely survive. Competitive evaluations made at these low points in the cycle have often deterred large corporations from entering the injection business, or caused them to leave it abruptly. Conversely, when the "index of press activity" is at a peak level, everybody wants to "get in on the act." They feel that an injection molding division could not only fulfill in-plant needs, but take on custom jobs from time to time.

This has seldom proved sound because of competitive factors. The bled-in overhead costs such molding divisions carry must sooner or later make their base prices unrealistic to the alert buyer of open press time. A few divisions have been successful, however, with large, custom moldings. Still another problem—a growing number of injection plants are operating in buildings furnished free by smaller communities. Their water and sewage costs are often cut, as well as their taxes for specific periods.

The recent rush to Puerto Rico was also revealing. At one time there were 19 different injection molding operations going on there. The many special problems of the injection industry came into sharp focus in Puerto Rico. Mold repairs, phone bills, air freight costs, and problems of supervision were among the many factors which caused this boom to break. I can recall others, like hard water problems and humidity. It is an important chapter in our industry, because it crystallized into a 4-year period all the problems which have made injection molding a dubious venture for big business. Injection machines consume somewhat less than 10% of all thermoplastic materials sold. It is not too surprising then, that many molding powders are not compounded to take the heat and pressure of an injection cylinder. A specific example of what happens when we buy too close and mold too fast and too thin from the wrong material is found behind the present slump in the plastic food container business. Here, brittleness and breakage led to a wholesale return to paper boxes late last fall. The real profit is, of course, in the contents of the food package, but the food people didn't stand still when trouble cropped up—and neither did the paper outfits.

The way this problem is reported in our industry is so polite and obscure, however, that one hardly realizes a crisis is present. I quote, "Very large potential markets exist for polystyrene containers in the field of frozen and refrigerated foods. Actual use, however, has been limited because of several factors. The medium-impact materials have lacked the cold strength necessary to withstand rough handling in stores and the high-impact polystyrenes, while offering adequate strength, carry a high cost tag for this highly competitive field."[#]

An executive analysis of the present setback in the use of molded plastic boxes might end with the conclusion that only the largest food processors can safely switch to plastics by assuming full control of the molding operation themselves, just as some detergent makers are now doing with blow molding. An alternative would be to insist that their supplier locate himself actually next door.

Centralized departmental control

The prime requisite to operating a captive injection molding division, as I see it, is to recognize the need for centralization of all authority in one injection molding department head. He must be able to operate without interference from the more traditional management coordinators. Such a department head must be fully responsible for:

1.—Tooling design and development. (Specialized departmental draftsman, and chasers or follow-up men are also suggested.)
2.—Material specifications and material purchasing. (Here usual purchasing department facilities can often still be utilized, but only for the mechanical routines of buying.)
3.—Molding standards and inspection.
4.—Maintenance.
(Here specially trained personnel can sharply reduce press downtime.)
5.—Selection and specification of all machinery and equipment.

This centralization of authority is an important area for immediate action in most injection molding divisions. The man should have previous specialized experience in injection molding, and should be able to operate with minimum interference by top management. Here, I must interject a word about the importance of personalities in the typical injection molding operation. Two distinct problems are posed by it, and both demonstrate the need for a rare combination of management caution with unusual independence from standard management controls. If a man is a "Reed" man, a "Lester" man, or a "Watson" man, for example, he can make machines of his brand into exceptionally productive tools. But if the management asks him to operate machines of other makes which it may have selected, there have been repeated instances where no amount of management persuasion could make the machines work.

Conversely, if a plant has been pre-sold on a given make of machine, there were few complaints as long as the men who bought them originally are still around. But if a change in personnel occurs—if the key men in the selection of the equipment leave—it often comes as a complete surprise how many problems actually existed.

Wilkinson, J. R., Modern Packaging, Feb., 1961

A case history

Because of our independent position as heating cylinder consultants dealing with injection machine obsolescence we have often been asked for suggestions as to whether an injection department should be started, discontinued, or operated as part of a larger operation. I do not believe, that any breach of professional ethics is involved if I give you the following extracts from a report we recently completed for a large molder of thermoplastics. They point up some of the specific recommendations we made to assist management in its decision to construct a plant devoted solely to its injection division.

Changes & suggestions

At X Company we found that all injection cycles were presently determined by mold cooling rates and operator speed and facility. Fully automatic operation of a typical job was virtually impossible due to the nature of the parts. Thus, there were few if any instances where heating cylinder plasticizing rates determined the molding cycle. Molds could almost always be placed in machines of sufficient size to handle them without the "bird's eye effect" bottom sinks or wormtracks which indicate either lack of plasticizing capacity or lack of press bulk factor capacity. Adequate press capacity and time was found for all molds up through 20 ounces.

The best opportunities for X Company were plainly in the production of larger molded articles which required preplasticizing presses of 100-200 ounces. Here, the relatively small number of competing machines which are capable of clamping large areas or for pulling deep draws would permit the use of a much more comparable cost base factor. Furthermore, relatively few concerns had the same physical facilities, floor space, heavy duty mold handling equipment, etc., necessary for efficient operation of really large injection machines. Few if any proprietary injection molders had comparable distribution facilities for large molded articles.

If any growth area was to be considered, therefore, we felt that it should be in installation of presses of 200 ounces and over. If any sacrifice of present facilities was needed to accomplish this growth, we indicated that it should be the elimination of presses of the 12 to 16 ounce size. This work could be jobbed-out economically, even if a full time follow-up man and expediter were hired to oversee it. We stated unequivocally that full centralization of authority in one autonomous department head was the most urgent consideration. This was particularly necessary to accomplish improvements in tooling, permit faster cycles, control shrinkage, and lessen downtime.

Actual tool design where X Company appeared weakest was outside the province of our survey. It was, however, the area where most action was needed and the simplest way to accomplish it was by the departmental autonomy. Lack of accurate information about actual molding costs made it difficult for the top management to evaluate X Company's present status and future role in the thermoplastic field. In our opinion, the information was available within the present organization, but was so heavily weighted with other charges not properly attributable to thermoplastics processing that it produced a highly distorted picture of molding costs. —THE END

The foregoing article is adapted from an address given to the Detroit Section of SPE at Rackman Engineering Center on Monday, February 13, 1961.

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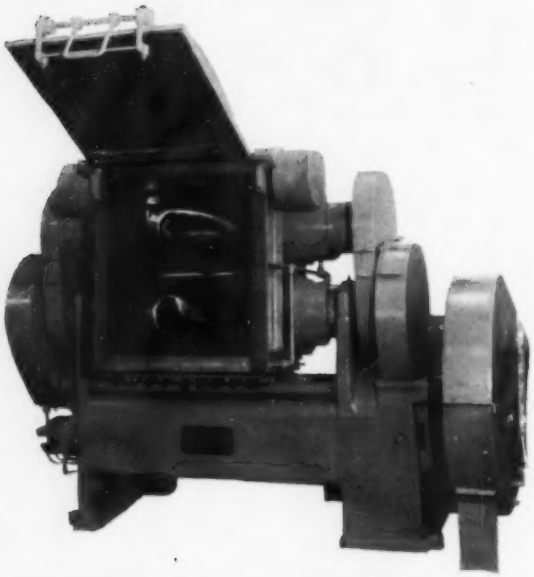


Single curve-blade mixer handles 220 lbs; working capacity is 50 gals.

Formulating reinforced plastic premixes

Batch mixing with Baker Perkins units. Variables include reinforcement, resin formulation, timing, cycle, and the unit used. Area of compromise is between surface finish and strength; the former improving with extended mixing, the latter with shortness of mixing time.—Editor.

In formulating reinforced plastic molding compounds, the main problem is proper mixing of the three principal ingredients: chopped glass strands, resin, and filler. Too rapid blending of resin and glass produces a mat which must be broken down to get good distribution of ingredients. The force required to effect this breakdown also breaks the fibers—resulting in a loss of strength.

Thus, the type of mixer involved is important if one is to come up with a properly balanced end-product with good surface finish and physical properties. A compromise must be reached somehow—between surface finish, which gets better with prolonged mixing; and strength, which improves in direct ratio to the shortness of mixing time.

Also, as glass content goes up, so does impact and tensile strength. But molding, mixing, and surface finish tend to go down. Increasing the fiber length has the same effect, and the best compromise is found to be the use of ½ inch strands.

Although many variations are used for any given specific compound or process, mixing generally consists of combining resin, catalyst, glass fiber, and sometimes a pigment plus a suitable wetting agent.

The resin is added to the mixer first, followed by a catalyst—usually some form of benzoyl for controlling shelf life. In some cases, a prepared resin is introduced with the catalyst already mixed. These vary in consistency from very thin to almost putty-like mixtures.

Normally, the wetting agent or filler is introduced immediately after the resin. These fillers, commonly, calcium carbonate, asbestos or wood flour, are chosen according to the needs of the particular compound. After a homogeneous mix is obtained, the fiber glass addition begins. Sisal, or a combination of sisal and fiber glass is used, depending on the process involved.

The time required for adding sisal or fiber glass varies. For example, either can be added progressively, so that the addition is completed by the end of the batch cycle; or they can be introduced practically all at once, with mixing continuing until the proper combination is achieved. Both procedures may be followed in batch mixing, although the progressive technique lends itself especially to a relatively new type continuous mixer, called a Ko-Kneader*. Several firms, including Ford Motor, employ it currently for automatic operations.

In a batch mixing operation, a most effective mixer appears to be a standard universal machine, shown in the accompanying view. With such a unit, it is necessary to control the mixing procedure to obtain optimum mixing in the shortest possible time thus preventing fiber breakdown.

Experience indicates that this will vary somewhat with the formulation involved. Try charging the resin and half of the filler to the mixer. Mix 2-5 minutes, charge glass over a period of 3-5 minutes, mix for another 2 minutes, then add the remainder of filler and mix for 2 more minutes.

Using a standard universal machine, the blade se-

*Trademark, Baker Perkins

Table I — Universal Machines

Working Capacity (gallons)	Total Capacity (gallons)	Horsepower	Batch (pounds)
0.7	1.0	2	4
2.25	3.5	2	12
10.00	15.00	15	55
20.00	30.00	20	110
35.00	50.00	25	190
50.00	75.00	30	220
100.00	150.00	50	440

lected is important for optimum mixing performance. Two types, either a Sigma or a 180° single curve dispersion type, will provide good results. The latter is preferred, because intensity of mixing is lessened. This causes less fiber degradation, while still offering the desired quality of the final product.

Single curve blades also effect an easier, more complete discharge, and no reversal of the blades is required. There is a tendency for material to work around the center wing section of the Sigma blade, and it requires more power.

Commonly-used machines are the 20 and 50-gallon working capacity units, which produce 100 to 200 pounds per hour. Blade clearance is held to about 5/16-inch. More than this will cause a film to form on the trough of the mixer, causing incomplete mixing.

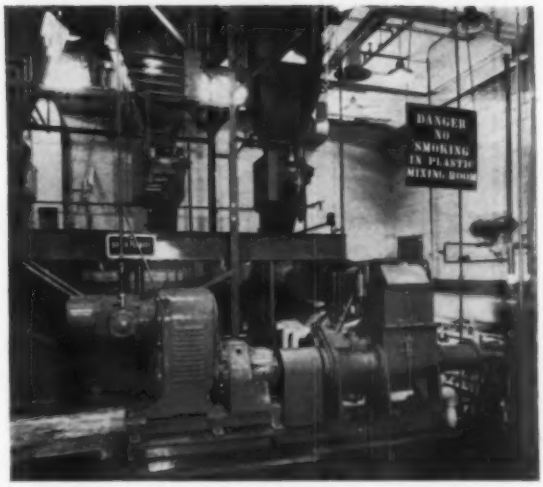
An accompanying table indicates some machine choices available for specific needs, based on a production output of 5-6 pounds per gallon of working capacity per batch.

A good general purpose molding material can be produced using 50% coated calcium carbonate, 25% polyester resin, and 25% glass strand. At optimum mixing, this formulation provides an impact strength of about 4 foot-pounds, and a tensile of 10,000-20,000 pounds per square inch. Sisal and other fillers can also be used. However, sisal is used to produce a more economical molding powder and should not be expected to offer the same strengths.

Cycle time for a given batch will vary depending on the product desired. About 5-7 minutes are required to prepare the resin. Total cycle time, excluding discharging, runs 10-45 minutes.

Mixer sizes over 8 gallons should include water jackets for cooling. Normally, there is no need for stainless steel as the construction material, but it may be necessary to avoid batch contamination.

In automatic operations involving a Ko-Kneader continuous mixer, the same materials are handled. Ford, for example, produces reinforced polyesters for heater housings at a rate of 2400-3000 pounds per hour. Materials involved are sisal, calcium carbonate, clay, asbestos, and resin. These are metered progressively into the mixer; the resin from steel storage tanks supplied by bulk tank trucks.



Reinforced polyester setup. Ingredients converge via common conveyor to Ko-Kneader mixer, then on to extruder. Output ranges to 3,000 lbs/hr.

Except for sisal fibers, the remaining components of the mix come bagged as powder. The resin is pumped automatically from the tanks to two resin mixers, where lubricant, pigment, and a catalyst are added. This slurry is then metered automatically and pumped directly into the hopper of a Ko-Kneader mixer.

The barrel screw of the machine both rotates and reciprocates. This action provides the balance between good surface finish and superior physical properties. The screw itself consists of interrupted screw thread, which works in conjunction with three rows of teeth attached to the mixing chamber or barrel. The stationary teeth of the barrel actually pass through the interruptions in the screw thread.

As a result, some material is always held back by each of the fixed teeth. This causes the material travel-through the mixer to be conveyed in loops, with each kneading tooth acting as a miniature mixer. Because of the large number of teeth, it is possible to achieve a high degree of mixing even with the relatively short retention time.

Short retention time minimizes fiber degradation, strength is retained, yet mixing is so thorough that a greater balance is achieved between surface finish and general physical properties. The possibility of contamination is also reduced, since the split construction of the machine's barrel ensures quick and easy cleaning. Since relatively small amounts of materials are handled at any given time, quality checks can be made frequently, to minimize the amount of spoilage or reworking.

—The End

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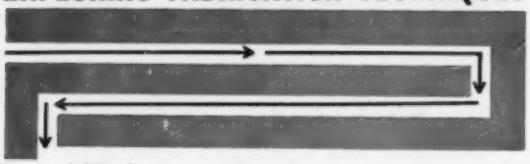

Foamed Vinyl

By L. J. ZUKOR, *ENGINEERING EDITOR*

PVC is finding important new uses in the cellular plastics field. Improved processing is awakening new interest in a material which had been relegated almost entirely to the manufacture of synthetic sponges. One of the prime reasons for vinyl foam's limited use was the high cost of ingredients and equipment. Now, however, it's possible to make an excellent, open-celled foam sheet or a foamed laminate on the same machinery used so successfully these many years to produce synthetic leathers and upholstery materials.

Both the plastics and fabric finishing industries have shown great interest in these foamed plastics. Primarily, this interest stems from the development and acceptance of thin unicellular plastics laminated to fabrics and other substrates, including interlining, windbreaker, and undergarment materials. This is in addition to upholstery and synthetic leather. With the introduction of polyurethane foams, however, vinyl foams began to lose ground due, in part, to the fact that polyurethane could withstand the rigors of solvent dry cleaning without disintegrating or separating. Vinyl foam, on the other hand, could not be cleaned in the chlorinated solvents, but could instead be cleaned by a detergent wash.

I have recently seen how a machinery manufacturer—Waldron-Hartig, and a chemical producer—Du-Pont, have combined their efforts to reintroduce a method which simplifies the manufacture of foamed vinyl products. The technique employs a chemical blowing agent for the preparation of *self-laminating* foamed vinyl.

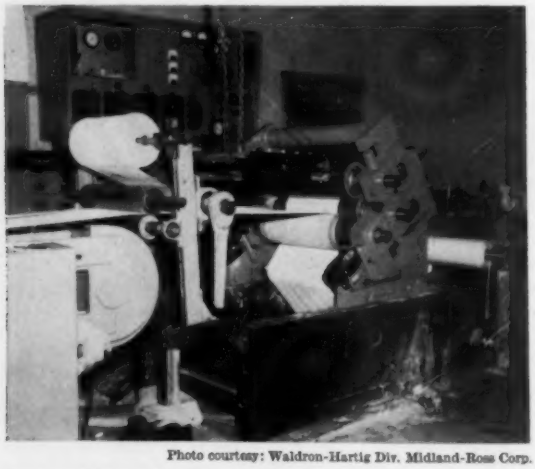

Photo courtesy: Waldron-Hartig Div. Midland-Ross Corp.

Feed end of machine—showing fabric station, expander roll and pinch rolls.

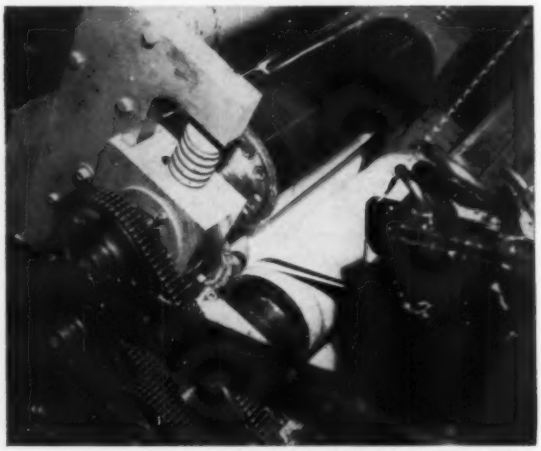

Photo courtesy: Waldron-Hartig Div. Midland-Ross Corp.

Reverse roll coater assembly—showing kissing roll depositing plastisol-blowing agent mixture to gel-coated release paper.

Mechanical and chemical blowing agents have been available to vinyl processors for more than a decade. The former included carbon dioxide gas which is mixed into a plastisol at low temperature and high pressure. This technique involved a heavy investment in machinery and refrigeration equipment, and the product was very difficult to control. Slab stock prepared by this method is non-toxic and is used to make open celled sponge. Employing another method gives molded closed celled items. These were virtually the only types of foamed vinyl products which had entered the plastics market.

Recently, however, even these products had been

(*Contd. on page 88*)

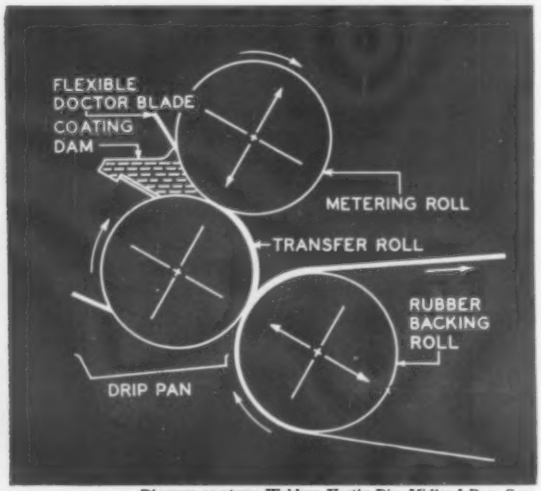

Diagram courtesy: Waldron-Hartig Div. Midland-Ross Corp.

Reverse roll coating arrangement.

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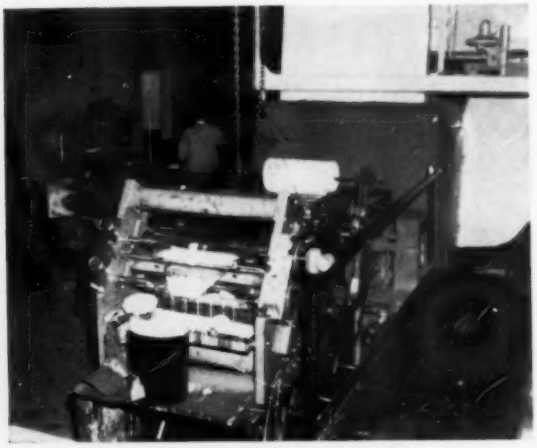
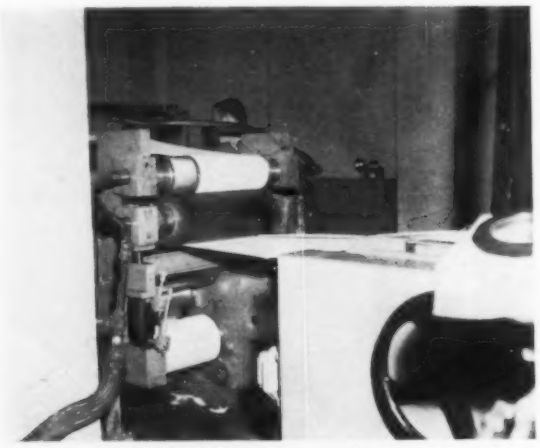
(Contd. from page 86)

	Preheat Zone		Oven Tempo. ° F. Zone			Air Velocity Zone			Belt Speed	Wet Coat
	° F.	Time	1st.	2nd.	3rd.	1st.	2nd.	3rd.	(ft./min.)	(mils)
Vinyl Topcoat Application	—	—	250	250	350	4000	4000	4000	20	5
Laminate Operation	280-350	5-15 sec.	250	250	350	4000	4000	4000	12	7 & 20

NOTE: All 3 oven zones can be maintained at the same temp. (350°F.) for a single-stage operation resulting in a slightly higher foam density.



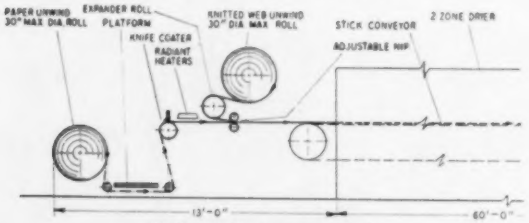
Front view of reverse roll coater



Embossing roll assembly

losing ground to the newer polyurethane foamed products. In the automotive industry alone, urethane foam has replaced all other foams in crash padding. Now, with the more enticing price of materials making up the plastisol, and better processing methods interest in vinyl foams is being revived.

Having mentioned the chemical blowing agents, I ought to explain that while they were commercially available and operable, many were not completely satisfactory for expanding PVC. They led to discoloration and odor development during decomposition (gas formation). Earlier foaming agents were relatively unstable, and decomposed on mixing or at temperatures too close to the gel point of plastisol mixtures. The result was non-uniform, unpredictable cell formations.



Knife coating arrangement

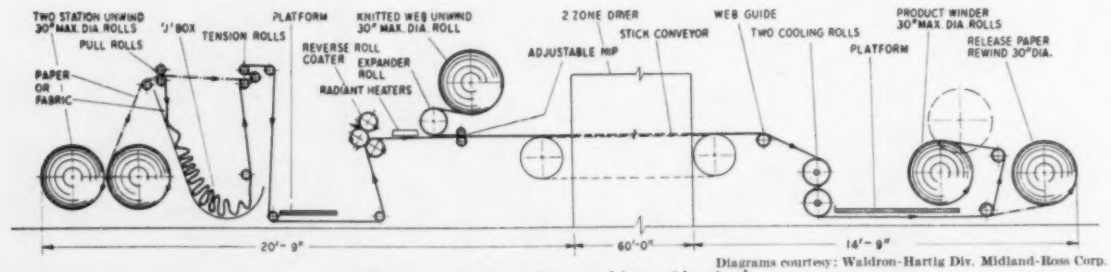
Still another drawback was the toxicity of some decomposition products remaining in the finished product.

To overcome some of these deficiencies, the DuPont explosives department synthesized Nitrosan, a nitrosoamide complex whose nitrogen releasing properties are better than many other organic compounds which decompose on heating. Nitrosan not only performs well with vinyl, but has long-term stability in storage.

When properly formulated, Nitrosan-blown vinyl results in a fine uniform cell structure. In common with other nitrosoamides however, it is a mild explosive. To make it safe, it is desensitized by thorough mixture with mineral oil in a 70/30 proportion. Slightly acidic or neutral stabilizers are recommended, otherwise almost complete freedom is possible in selecting compound ingredients.

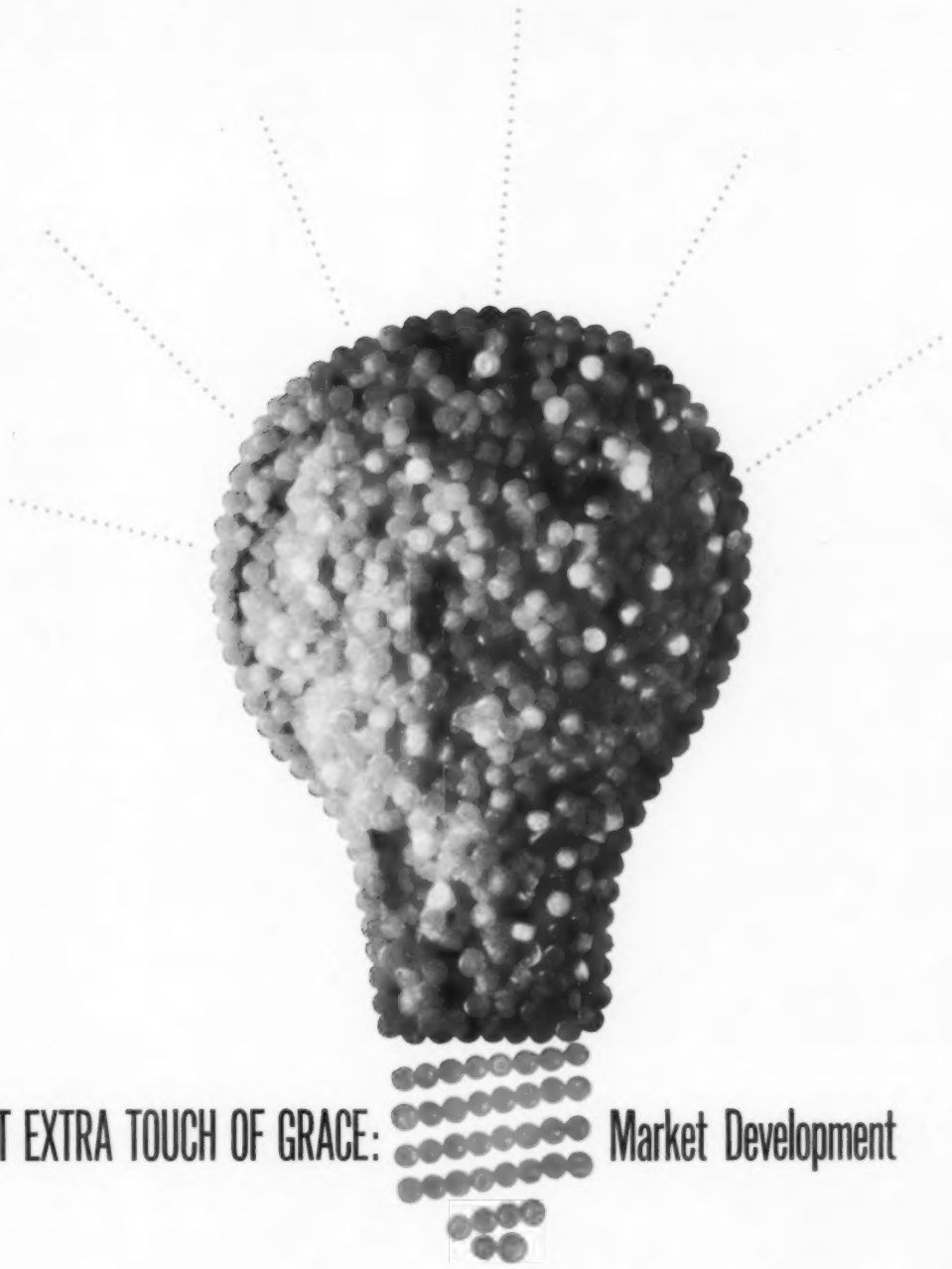
Mixing blowing agent with plastisol should be done just prior to using it at the coating machine. On small batch mixing, a paint stirrer or Hobart type mixer is generally all that is needed. Large batch mixing is best done in a ribbon type blender or large mixing kettle. Mixers and storage vessels should re-

(Continued on page 90)



Diagrams courtesy: Waldron-Hartig Div. Midland-Ross Corp.

Reverse roll coater diagram (drive side view)



THAT EXTRA TOUCH OF GRACE: Market Development

Whether it's your new product idea or ours, it always sounds great at first blush. To be sure it is, Grace will check it out (in the strictest confidence) with jobbers, buyers and consumers. This program to develop new saleable end uses for modern thermoplastics is one of the 10 major services available to Grace customers as part of the Grace Service Plan. To the many manufacturers who have successfully used this service, it is one more proved example of that extra touch of Grace.

W. R. GRACE & CO. POLYMER CHEMICALS DIVISION, CLIFTON, N. J.

HIGH DENSITY POLYETHYLENE, LOW AND MEDIUM DENSITY POLYETHYLENES, POLYSTYRENES.

GRACE
PLASTICS

(Contd. from page 86)

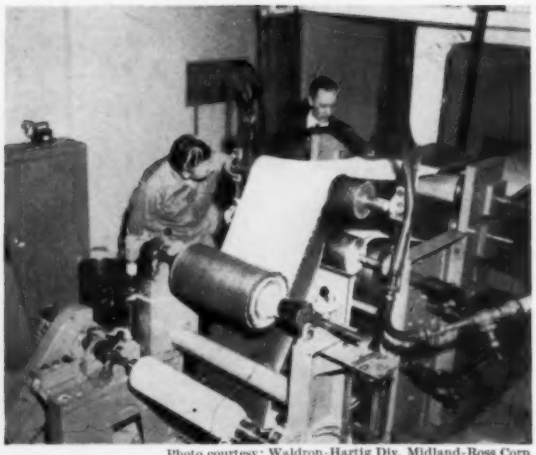


Photo courtesy: Waldron-Hartig Div. Midland-Ross Corp.

Take-off end of coating machine—showing laminate, stripped from release paper, being embossed then wound for removal.

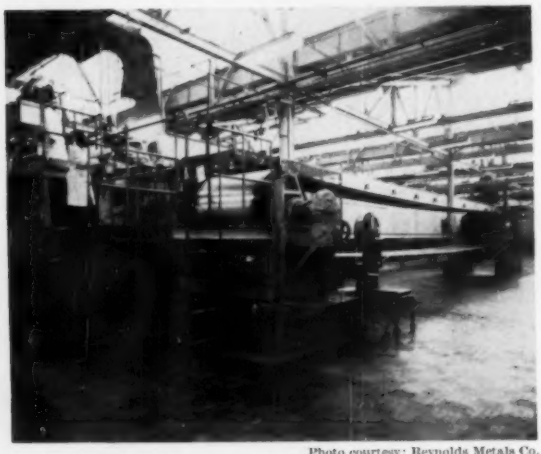


Photo courtesy: Reynolds Metals Co.

Stainless steel continuous band caster in operation at Reynolds Metals Company's plastics plant, Grottoes, Va. Film casting machinery of this type can also be adapted to the production of free foamed sheeting or foamed laminates.

Photo courtesy: Reynolds Metals Co.

Casting machine take-off end—showing film stripping from the highly polished band.

main open to atmosphere because once the blowing agent is introduced, there is always some release of gas. The mixture remains stable for periods of several weeks in storage. One pass on a three roll mill is usually sufficient to mix the blowing agent into a milling type plastisol.

At Waldron Hartig Co. I was able to examine closely a coating machine set-up used to produce a foamed laminate. Because of the experimental nature of this machine, several mechanical features were interchangeable, an instance being that a knife coater could be interchanged with a reverse-roll coater. The machine actually consisted of the reverse-roll coater, a release paper unwind station, a preheater, a fabric unwind station with expander roll, adjustable nip rolls, a 3 zone tunnel oven, a release paper rewind, a product rewind, and a set of embossing rolls.

After threading the release paper through the machine, start-up was effected by filling the dam with plastisol. The gap between the metering roll and the transfer or kissing roll was adjusted to place a two-mil layer of plastisol on the release paper. After partial fusing on passage through the oven, (velocity 15 ft./-min.—1.6 min. holdup in oven) the vinyl-release paper laminate was collected at the rewind end.

The partially fused vinyl skin, still on the release paper, was re-run through the production line. Between 5 and 10 mils of expandable plastisol was applied to the vinyl skin with the reverse-roll coater.

The plastisol was passed under a bank of Chromolox heaters at a rate of 12 ft./min. before the cloth was applied. The amount of heat applied was regulated by varying the distance between the heater and the plastisol. The object was to apply just enough heat to increase the viscosity of the plastisol so it would not strike through the cloth. Passing cloth over the expander roll eliminated wrinkles. The nip rolls affixed it to the plastisol with slight pressure. Trial runs at Waldron were made using knit jersey #30 and jersey interlock because of difficulty usually encountered with these materials in a plastisol coating operation. Other loosely woven fabrics of comparable mesh can also be used without experiencing plastisol "strikethrough" in the finished product.

The laminate was then passed through the first stage of the oven at 250°F. for 80 seconds to decompose the Nitrosan. Added heating at 350°F. for 40 seconds fused the vinyl.

The vinyl laminate was chilled and separated from the release paper. Because of the low processing temperature, the release paper can be used several times. The surface of the laminate was softened by passing it under a second bank of Chromalox heaters. A cold roll embossed the vinyl after which it was wound onto the final take-up roll.

The application of a dull coat was not necessary because the vinyl skin was not exposed to high temperatures and consequently did not develop high gloss.

As a matter of interest, those desiring to produce such products would be well advised to inspect the method disclosed in U.S. Patent 2,813,052.

—THE END

the big news story for suppliers and users of elasto-plastic components!

TEXIN

Now Permits Mass Production of Urethane Elastomer Parts by Low-Cost Injection and Transfer Molding or Extrusion

TEXIN, a newly-developed urethane elastomer "green stock" resin supplied in chopped particle form, is designed for those mass market industrial applications which require a highly-functional elasto-plastic material that can be simply processed with existing equipment by fast-cycle, low-cost methods.

TEXIN by-passes the costly, time-consuming liquid casting system formerly required in processing cured urethane elastomer items. Yet, it gives you the immediate market advantage of a thoroughly field-tested material, with properties identical to cast Multrathane® elastomers, while reducing part-forming time from hours to a matter of seconds.

TEXIN is specially formulated for heavy-duty applications which demand the unusual combination of wear resistance, hardness, elasticity, and high impact and mechanical strengths — particularly in original equipment components having difficult design features such as undercuts, slots, tapers, gear teeth, inserts and threads subject to high abrasive wear or oil immersion. Literally hundreds of these applications, many not adaptable to casting methods, are 'right' for molded urethane elastomer. TEXIN can bring them in.

The markets for urethane elastomer items are already well developed and waiting to hook into your production line. For full details and technical assistance, write immediately to Mobay Chemical Company, Code PS-1, Pittsburgh 5, Pa.

e-8

Typical minimum physical properties of two grades of TEXIN

Type	Specific Gravity	Bulk Factor	Hardness		Tensile Strength	Elongation at break	Tensile Modulus psi			Elongation Set	Tear Strength
			Shore A	Shore D			100%	200%	300%		
192 A Molding Grade	1.25	2.7	92-94	44-45	4400 psi	600%	1150	1550	2050	45%	300 lbs.
280 A Extrusion Grade	1.25	2.7	80	—	5500 psi	600%	650	900	1500	30%	—

Send for your copy of Texin Topics, an illustrated bulletin describing the latest application developments in the urethane elastomer field.

VISIT SPACE NO. 1333
9TH NATIONAL PLASTICS EXPOSITION
JUNE 5-9, 1961 COLISEUM, N.Y.C.
sponsored by
Society of The Plastics Industry, Inc.

MOBAY

HERCULES **Packaging Hi-Lites**

Modern polyolefins make handy, handsome packages

Functional, eye-catching, low-cost containers prove sales key to many markets

With self-service the modern king of marketing, the package now rules as the product's star salesman. Today's package must be more than a functional carrier or an eye-catching wrap. The *right* package is a complete merchandising tool: the base on which effective advertising is built; a container which reflects and protects product quality; an action-stimulating factor at the point of sale.

Packages made with modern polyolefins combine all these important features with another must: *low cost.* Both Hi-fax® high-density polyethylene and Pro-fax® polypropylene are now revolutionizing packaging concepts in such large volume markets as detergents, drugs, cosmetics and food, to mention just a few. They display the product right, protect it enroute to consumer, and help to close the sale—and all at a new low in packaging costs. Here's a look at some of today's exciting new packages, made possible by these new and better plastics designed to meet *modern* requirements.

The new SINGER Buttonholer package hinges on Pro-fax

They've been sewing buttonholes in garments for more than five hundred years, but never with equipment like this. Singer Sewing Machine Company's ultra-modern buttonholer attachment is designed to make short work of this intricate, time-consuming job. It's packaged in tune with the times in a high-styled, durable, *permanent* package molded with Pro-fax. Box and lid are made in one piece, with an integrally molded hinge that grows stronger with use. Molded-in compartments hold all the interchangeable templates in the unit conveniently in place.

Molded by Consolidated Molded Products Company, Scranton, Pennsylvania, for Greist Manufacturing Company, New Haven, Connecticut.

Hi-fax handles drug products, too

Eli Lilly and Company led the way in introducing plastic bottles for dry products with these attractive, compact containers blow-molded with Hi-fax. One-fifth smaller than the glass bottle required to package an equal number of tablets, they are only one-tenth the weight of a glass container. Hi-fax bottles can be in the amber color traditional for pharmaceutical packaging, or in exciting modern pastels.

Blow-molded by Continental Can Company, Chicago, Ill.

Pro-fax handles cream products

This IMCO double-walled jar is made of Pro-fax . . . an unlined jar which is impermeable enough to hold most cream products. Molded to match the dimensions and capacity of standard flint and opal jars, it is five times lighter than flint, lighter still than opal. Color possibilities are unlimited, breakage practically eliminated, and shipping costs greatly reduced. Another *modern* solution to a tough packaging problem made possible by versatile Hercules polyolefins.

Manufactured and distributed by IMCO Container Corporation, Kansas City, Missouri

Hi-fax handles new design concepts

When your new packaging idea calls for new concepts in material performance, Hi-fax often provides the solution. Improvements in plastic container engineering techniques, coupled with the superior plastic properties provided by Hi-fax, make this outstanding new IMCO package for Mennen's *Brake* a powerful merchandising tool. Hi-fax can handle your new concepts in containers, whether they be for detergents, drugs, cosmetics or household chemicals.

HERCULES POWDER COMPANY
INCORPORATED
Hercules Tower, 910 Market Street, Wilmington 99, Delaware

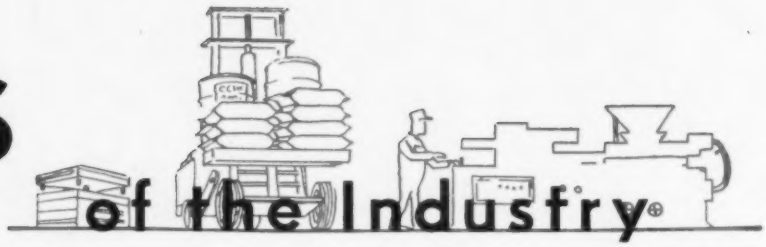
THREE NEW MATERIALS FOR THE PLASTIC INDUSTRY

HI-FAX® HIGH-DENSITY POLYETHYLENE • PRO-FAX® POLYPROPYLENE • PENTON® CHLORINATED POLYETHER

HERCULES

CP61-7

NEWS of the Industry



general/specific interest

Princeton University has set up a graduate plastics program with fellowships of $1,500-2,100 plus tuition and board. Opportunities for employment as half-time research assistants at $2,000 per academic year are available to students not on fellowships. Applicants must hold a Bachelor's degree in engineering or physical science. For information, contact Prof. Louis F. Rahm, Plastics Laboratory, Princeton University, Princeton, N. J.

SPI's Pre-Preg division has issued three new standards for the testing of pre-preg laminates: resin and volatile content, flow, and gel time. Copies can be obtained from the Society, 250 Park Ave., New York City.

Massachusetts Institute of Technology has scheduled two plastics lab courses for this June: The Technology of Reinforced Plastics, June 19-23; and The Science of Adhesion.

Tykor Products Division, Borden Co., has replaced glass jugs and metal pails for packaging liquid cleaners and sanitizers with plastic containers.

new plants, labs & additions

Conforming Matrix Corp. has moved into its new plant at 830 New York Ave., Toledo, O. The building contains 22,500 square feet of floor space, 19,800 of which are devoted to production, 1,500 to engineering.

General Electric has scheduled a $750,000 expansion of its phenolic molding compound plant in Pittsfield, Mass. Capacity will be increased 30% on completion in early 1962.

Electronic Mechanics, Inc., is nearing completion of its 500-ton annually synthetic mica plant in Clifton, N. J.

Strux Division, Aircraft Specialties Co., Inc., Hicksville, N. Y., has announced increased production facilities for rigid urethane boards, slabs, and molded shapes. The firm's trade name for the material is Ascofoam.

Havrill Corp. is building a $1,300,000 manufacturing facility for molded plastic products and die cast items. Located near Compton, Calif., the 101,000 square foot plant will increase production capacity by a third.

U. S. Industrial Chemicals Co. has begun construction of a 60-million pound-per-year linear polyethylene plant adjacent to its conventional polyethylene plant in Houston, Tex. Completion is expected for the second quarter of 1962.

Owens-Illinois Glass Co. is building a plant for the production of blown plastic bottles in Jersey City, N.J., the sixth plastic bottle plant opened by Owens-Illinois in three years.

W. E. Pipkorn Mfg. Co. (WEPCO), maker of formed wire products and custom fabrications, has doubled its plant area in St. Paul, Minn., from 6,400 to 12,800 square feet. Output is expected to triple.

U. S. Peroxygen Corp., manufacturer of organic peroxides, has expanded its plant facilities in Richmond, Calif., to triple output of BZQ 50 and 55. The materials are non-separating benzoyl peroxide pastes used as polymerization catalysts.

business developments

Lehigh Chemical Co., Chestertown, Md., has entered the plasticizer manufacturing field. Joseph P. Clancy has been named manager of the newly created plasticizer division.

Lock Joint Pipe Co., East Orange, N.J., has formed a plastics division with R. J. Sweitzer as general manager. Headquarters will be in Wharton, N.J.

Spencer Chemical Co. has consolidated the technical laboratory activities of its plastics division works in Orange, Tex. Complete facilities for polyethylene technical service will now be under one roof.

Producto Machine Co., Bridgeport, Conn., has formed a division for the design, development, and manufacture of blow molding and sheet forming machinery.

Insulfoam, Inc., a newly established firm located in Keyport, N. Y., has announced continuous production of rigid urethane-filled insulating panels for refrigerator trucks and railroad cars.

Powertron Ultrasonics Corp. has announced a new development for the ultrasonic sealing of plastic film. Film thicknesses from 1-20 mils have been realized in multiple (2-10) layers.

Pall Corp., Glen Cove, N.Y., has set up a subsidiary, Fibrous Glass Products, Inc., which will manufacture glass fibers in Wilkes-Barre, Pa. The plant will have a capacity of 10-million pounds annually, and will cost $1,800,000.

Lasco Industries, Inc., Los Angeles producer of reinforced plastic building panels and rigid pipe has initiated production of flexible polyethylene piping.

Container Corp. of America will produce expanded polystyrene for protective inner packing of fragile products at its Mengel division plant in Louisville, Ky. A molded foam department has been established, with William J. Clower as manager.

ANNOUNCING

Campbell-Kent

A new association of interest to manufacturers of rubber and plastic products, combining a total of 87 years experience in design, development and manufacture of machinery and equipment for the rubber and plastics industries.

DESIGNING AND DEVELOPMENT will be handled by Campbell Machinery Development Co. under the personal direction of John Campbell whose efforts during the past 33 years have been responsible for the origination of machines widely used in the production of various kinds of rubber and plastic products.

Machines bearing the Campbell name are key processing units in plants throughout the United States and in foreign lands.

MANUFACTURING AND SALES will be handled by the Kent Machine Co., a Division of The Lamson & Sessions Co.

The Kent Machine Co. since its founding in 1907 has been a principal supplier and builder of rubber machinery.

Combining The Lamson & Sessions Co. organization, The Kent Machine Co. facilities and the Campbell design experience will result in making available complete design and manufacturing services to the entire field.

A FEW FEATURES

Handles entire sheets of molded rubber products direct from the curing line.

Press a button. The "flash" is cut free and the finished parts drop into a tote box or onto an automatic conveyor.

Operation is automatic except for the removal of the severed "flash" by the unskilled operator.

•

Exclusive "roll-lift" operation eliminates double impression cutting, increases die life and aids in giving up to ten times faster production than some equipment. Has trimmed up to 40,000 centers per hour.

•

Also trims and die cuts intricate gaskets and other products made from natural or synthetic rubber, cardboard, closed and open end sponge rubber, cork and other materials.

•

Combines speed of operation, rugged construction, and efficient operation with minimum maintenance.

Popular in the line of machines—the *Campbell-Kent* ROLL-LIFT AUTOMATIC TRIMMER

SERVICES

In addition to Trimmers we make numerous other machines some of which are listed below.

We also refine, engineer and build other machines based on customer's ideas.

The advice of our sales engineers is available without obligation.

Or we will submit recommendations for the improvement of methods or the solution of difficulties.

Write, phone or call.

Campbell-Kent

113 East Portage Trail **Cuyahoga Falls, Ohio**

Division of The Lamson & Sessions Co.

COMMENT

Regarding The Campbell Designed Trimmer

The most revolutionary method of trimming molded rubber goods developed in a quarter century.

•

Production of caster cups rose from 1200 to 4000 trimmed pieces per hour.

•

Brake cups trimmed at 30,000 pieces per hour compared to 4000 pieces formerly.

•

35,000 golf ball centers trimmed per hour compared to 8000 trimmed by the dry ice tumbling method.

•

Cost of trimming brake cylinder boots reduced from 90 cents to 18 cents per thousand.

•

Gas tank gaskets requiring simultaneous inside and outside trim handled at 6400 pieces per hour.

For Information on Other Machines Check Items, Clip Coupon and Mail With Your Letterhead

- ☐ "Roll-Lift" Die Trimmers
- ☐ Slab Slitters (Plastic Foam)
- ☐ Slab Slitters (Rigid Foam)
- ☐ Roll Plastic Foam Slitters
- ☐ Cushion Cutters
- ☐ Laboratory Model Slitters
- ☐ V-belt Manipulators
- ☐ V-belt Skiving Machines
- ☐ V-belt Notching Machines
- ☐ V-belt Measuring and Matching Machine
- ☐ V-belt Curing Cans and Cages
- ☐ Horizontal Ball Molders
- ☐ Soapstone Dispensers & Dusters
- ☐ Foam Rubber Bagging machines
- ☐ Floor Tile Cutters

New Materials

For more information check Readers' Service Card (p. 131)

Liquid epoxy resins

As the result of an agreement with Union Carbide Plastics Co. Thiokol Chemical Corp. is now marketing liquid epoxy resins trademarked Tipox. Depending upon the hardener, the resins may be used in coatings, castings, or adhesives. For most applications, modified aliphatic amine catalysts are recommended. Three Tipox aliphatic amine hardeners, with viscosities of 2,500-4,000, 3,000-2,500, and 30-40 cps., are suitable.

Of the three resins now available, Tipox A has specific gravity of 1.12-1.14 and viscosity of 500-700 cps.; B has specific gravity of 1.15-1.17 and viscosity of 11,000-14,000 cps.; and C has specific gravity of 1.19-1.21 and viscosity of 12,000-19,000 cps. Typical properties of unfilled compounds cured with Tipox hardener 1 at room temperature and post cured for two hours at 220° F. follow.

	A	B	C
Pot life, 1 lb. mass, 77° F., min.	12.5	11.5	10.5
Hardness, Rockwell L	110	116	118
Flexural strength, psi., 77° F.	16,000	16,000	16,000
Modulus of elasticity, psi., 77° F.	0.4×10^6	0.4×10^6	0.4×10^6
Tensile strength, psi., 77° F.	8,700	9,500	8,000
Compressive strength, psi., 77° F.	19,000	21,500	23,500
Volume resistivity, 73° F., 50% R.H., megohm-cm.	$>5.5 \times 10^8$	$>5.5 \times 10^8$	$>5.5 \times 10^8$
Surface resistivity, 73° F., 50% R.H., megohm	$>2.0 \times 10^8$	$>2.0 \times 10^8$	$>2.0 \times 10^8$
Dielectric constant @ 1 kc., 73° F., 50% R.H.	4.33	3.56	—

Readers' Service Item 1

Silicone potting compound

General Electric Co.'s LTV 602 clear silicone potting material cures at 70-80° C. to a flexible, resilient solid which provides mechanical and dielectric protection for electronic components and assemblies. The material cures to a self-supporting, nonflowing state. It can be cut away in order to repair or replace embedded parts, and new material poured into the cut out section without leaving a scar.

Since viscosity of the uncured compound is 800-1,500 cps., LTV 602 will pour easily and will flow about intricate pieces. Its resilience prevents damage to potted components subject to thermal cycling. Further, it has resistance to both moisture and complete water immersion.

Typical cure times on potted electronic assemblies are 16 hours at 75° C. or 72 hours at room temperature. Useful temperature range is —65° C. to 175° C.

Readers' Service Item 2

Self-extinguishing epoxies

Dow Chemical Co. has developed two self-extinguishing epoxy resins curable with common epoxy hardeners. The resins, which are made self-extinguishing through the substitution of bromine on the epoxy molecule, are expected to be used in laminated aircraft and electrical parts, filled castings, aircraft and missile adhesives, and marine and architectural coatings.

Experimental resin X-3442 is a semisolid containing about 49% bromine, and is blended with liquid epoxies. Resin X-3441.1, a solid containing about 19% bromine, can be used alone or with conventional solid resins.

Physical and electrical properties of castings and laminates made with the resins are reported to be comparable to properties developed by non-self-extinguishing epoxies. Modulus properties are reduced at 300° F., but the company expects that blends of self-extinguishing epoxy with epoxy novolac resin will result in higher modulus at elevated temperatures. Prepreg laminates made with the resins meet the NEMA G-11 physical and electrical properties, except for flexural strength.

Readers' Service Item 3

Rigid urethane system

A rigid urethane foaming system, based on two components that can be combined on a one-to-one ratio, has been developed by Archer-Daniels-Midland Co. A polyether-blown formulation that can be sprayed or hand poured, the system is designed for insulating, void fitting, and similar applications. Mixing a pint or a pound of Aropol 7825 with the same amount of 7846 will produce approximately one cubic foot of foam, of a density of 1.5-1.7 pounds per cubic foot. The two components are of equal viscosity and weight.

Of the two components, Aropol 7846 contains the emulsifier, catalyst, and halogenated hydrocarbon foaming agent.

Among typical properties of a 1.5 pound density foam made from Aropol 7825 and 7846 are:

Compression strength, 10% deflection, psi.	35–40
Tensile strength, yield, psi.	45–50
K factor, BTU/hr./sq. ft./°F./in. thickness	0.120–0.150
Closed cell content, %, minimum	90
Serviceable temperature range, °F.	—65 to 224
Elongation at 70° F., %	10
Elongation at 40° F., %	6
Water absorption, room temp, 24 hrs., %	2–3
Foam tack free time, minutes	5

Readers' Service Item 4

Antistatic agents

American Cyanamid Co. is now offering Catanac SN and SP antistatic agents in isopropyl alcohol-water solutions. The amber 50% solution of SN is miscible with all polar solvents of low molecular weight. It is not corrosive. The 35% solution of Catanac SP has a light yellow color.

Both may be used in plastics either by incorporation into the molding composition or by surface application. For example, polystyrene, PVC, or polyethylene pellets or beads may be soaked in a 10% solution of SN or SP, air dried, and molded according to conventional methods. The molded product will be free of static charge and will retain the antistatic quality even after washing with soap and water. The agents can also be incorporated into calcium carbonate and other inert fillers. The products again will be permanently free of static.

The agents may be applied by spraying or wiping to the surfaces of molded products, conveyor belts, sheeting, etc. This method results in a coating which is as effective, but less durable, than distribution throughout the article.

Readers' Service Item 5

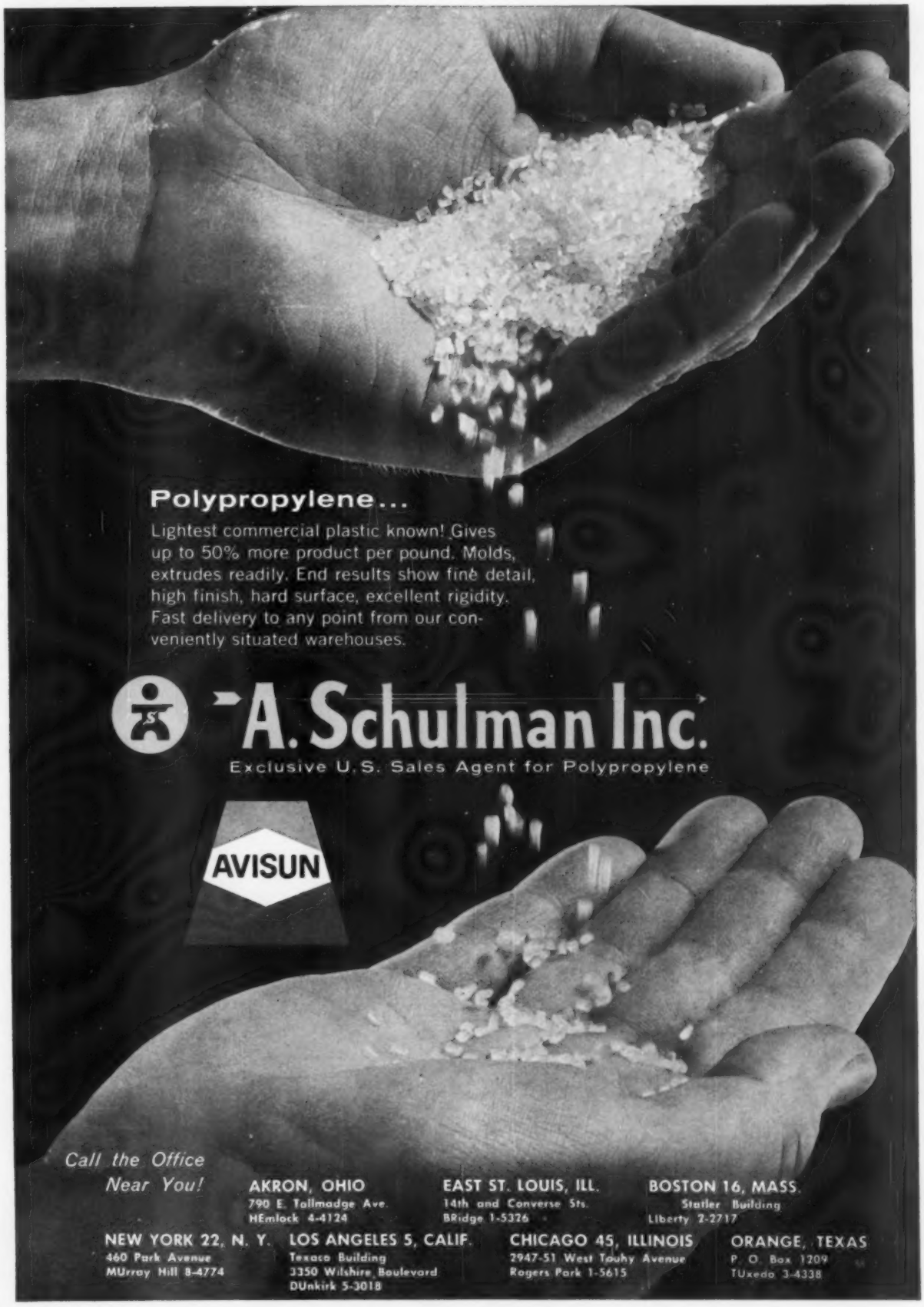
Fiberglass mat and tape

Houze Glass Corp. has made available preimpregnated, parallel glass fiber mats and tapes. Type T, available as a mat 38 inches by 13 feet and as tape 3 to ⅛ inches wide, has approximately 84% glass content impregnated with epoxy resin. It is recommended for winding. Type S, available only as a mat, has 78% glass content with modified epoxy resin. It is suited for bi-directional mat fabrication and honeycomb sandwiches.

Optimum properties will be obtained with a cure cycle of 1 hour at 300° F. at pressures from contact to 250 psi. followed by a post cure of 12-16 hours at 320° F. The uncompressed material is 0.018 inch thick. It will laminate 0.008-0.012 inch per ply.

In a unidirectional flat laminate, the ultimate flexural strength is 256,000 psi., and the ultimate tensile strength, 230,000 psi.

Readers' Service Item 6


Polypropylene...
Lightest commercial plastic known! Gives up to 50% more product per pound. Molds, extrudes readily. End results show fine detail, high finish, hard surface, excellent rigidity. Fast delivery to any point from our conveniently situated warehouses.
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Exclusive U.S. Sales Agent for Polypropylene
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14th and Converse Sts.
BRidge 1-5326
BOSTON 16, MASS.
Statler Building
Liberty 2-2717
NEW YORK 22, N. Y.
460 Park Avenue
MUrray Hill 8-4774
LOS ANGELES 5, CALIF.
Texaco Building
3350 Wilshire Boulevard
DUnkirk 5-3018
CHICAGO 45, ILLINOIS
2947-51 West Touhy Avenue
Rogers Park 1-5615
ORANGE, TEXAS
P. O. Box 1209
TUxedo 3-4338

Low viscosity epoxy

Reichhold Chemicals, Inc., has developed a low viscosity, liquid epoxy resin that is non-volatile and will not boil at room temperature under vacuum.

The resin has a viscosity of 1,000 cps. and a boiling point over 150° C. at 5 mm. Hg absolute pressure. It is nearly odorless.

Epotuf ED-1025 has been engineered for electrical and coating uses. It can be cast under vacuum to assure complete impregnation of a coil or motor winding, without developing any foam-out. It also is applicable for large open laminates.

Readers' Service Item 7

High speed coating resin

A polyethylene resin designed to give optimum performance in low coating weights at high speeds is available from Spencer Chemical Co., who reports that it has been extruded at weights of 1.1 pounds per ream at speeds as high as 800 fpm. Poly-Eth 1018, with 0.915 density and melt index of 12, is expected to be most useful in high production applications which use polyethylene as a sealing material as well as a barrier. Besides this use in several types of laminated pouches and multi-wall bags, it has also found application in foil freezer paper and boxboard.

Readers' Service Item 8

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Whittaker, Clark & Daniels, Inc.
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Plastisol stabilizers

Two stabilizers for organosols and plastisols function by the synergistic action of metallic and non-metallic components. In this way, says Ferro Chemical Corp. about its 1776 and 1777 stabilizers, they provide outstanding yet economical stabilization.

Both are light amber liquids of A viscosity. Ferro 1776, intended for unfilled, clear plastisols, has a specific gravity of 0.96. Ferro 1777, with specific gravity of 0.15, is generally used for filled plastisols. Other properties attributed to these stabilizers are: good early color retention, resistance to early light yellowing, excellent viscosity characteristics, good air release, non sulfur staining, and good long term light stability.

Readers' Service Item 9

Also Worth Mentioning—

☐ Rulon Spray, an aerosol-packaged, reinforced fluorocarbon slip and anti-stick agent has been introduced by Dixon Corp. Useful for metal, wood, plastic, and leather surfaces, the spray provides a low friction, dry film which is chemically inert, insoluble, and thermally stable to over 500° F. Coefficients of friction as low as 0.07 have been reported.

Readers' Service Item 10

☐ Lea Manufacturing Co.'s Lint-Off No. 7527 can be buffed or wiped on plastic surfaces to prevent accumulation of static-attracted dust and lint. When applied to thermoplastic or thermosetting plastic materials, it leaves a transparent colorless surface coating which will not damage the product.

Readers' Service Item 11

☐ Isochemwax 1812, a product of Isochem Resins Co., can be used for temporary protection of components during casting, potting, dip coating, or embedding with epoxies. This strippable coating conforms to the surface it envelops, but does not adhere to the surfaces. Specific gravity is 0.93; melting point is 225° F.; viscosity at 250° F. is 2300 cps.; flash point is 580° F

Readers' Service Item 12

☐ Maraset 533A is a two-component, contact-pressure epoxy adhesive curable at room temperature. Developed by Marblette Corp., the adhesive can be used with all plastics except polyethylene, vinyl, and Teflon; as well as with metals, wood, glass, etc. Tests with an aluminum-aluminum bond indicated that tensile shear strength after two days at room temperature is 2,650 psi.

Readers' Service Item 13

☐ Cutting edge cleaner, a product of Grace Fabri-Tool Co., dissolves plastic material build-up from the cutting edges of router bits, saw blades, etc. Tools are soaked in the cleaner for at least an hour, and then wiped clean.

Readers' Service Item 14

New Equipment

Shaker screen

A custom built screening unit from Derrick Mfg. Co. may be of interest to vinyl processors for sizing particles and removing dust. The welded frame; the ⅓ hp., 60 cycle, 3,600 rpm. motor; and the steel, stainless steel, or aluminum screens are reported to insure accuracy of separation without external vibrations. Model J vibratory screener can be supplied with dust enclosures, portable hoppers, wash boxes, feeders, and screen heaters.

Readers' Service Item 21

Laboratory mill

A laboratory mill to compound plastic materials for pilot production and testing is available from Dilts Division, Black-Clawson Co. The Dilts-JMC all-purpose lab mill has two six-inch diameter by 13-inch face steel rolls operating at a 1.25:1 friction ratio. Driven by a 7½ hp motor, rolls are micrometer adjusted with spring return loading. The unit will operate at temperatures up to 450° F. using oil, or 350° F. using steam.

Readers' Service Item 23

Web inspection device

The Mount Hope Machine Co., Inc.'s web viewer makes it possible to inspect moving plastic film and sheet visually, while machines are operating at normal production speeds. An oscillating mirror system creates the illusion that a section of material under observation is standing still. The mirror holds the given section in view so that colors, structure, and register can be observed.

The mirror system operates at 400 cycles per minute. Thus, materials running at speeds up to 1,500 feet per minute can be examined in 45-inch long sections. A retractable 4X binocular permits closer inspection of any area within the section.

Readers' Service Item 24

Replacement injection nozzles

Header Tool Co. has introduced a comprehensive line of replacement injection machines nozzles of its own manufacture. The company has available all types and sizes of nozzles for OEM equipment and parts replacement, special extension nozzles, and custom made nozzles. All makes and models of injection machinery can be accommodated.

Readers' Service Item 22

For more information check Readers' Service Card (p. 131)

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Injection molding machine

Off. A. Triulzi s.a.s. has developed an injection molding machine with a single stroke shot capacity of 423 ounces. This large capacity machine is distributed in the United States by Barclay Industries, Inc.

The press has a locking capacity of 1,-984 tons. Other specifications include: plasticizing capacity, 772 pounds per hour; minimum and maximum mold thicknesses, 20 and 39 inches; moving platen stroke, 59 inches; and dimensions of platens, 78.7 by 82.6 inches.

Readers' Service Item 25

Universal spray gun

The R-2 spray gun, recently introduced by U. S. Gypsum Co., sprays materials in a viscosity range of 10-18,000 cps. The gun can be used for spraying polyester laminating resins and gel coats for prototype, pilot, and experimental production; and epoxy surface coats and laminating resins for tooling and patternmaking and pilot and experimental production.

The gun is shipped with #4-C nozzle lid for 16 and 32 ounce cups. Laminating resins require air pressures of 40-60 psi.; polyester gel coats and epoxy surface coats may require pressures up to 90 psi. Output of low viscosity resin is 1-2 pounds per minute, and high viscosity resin, ½-1 pound per minute.

Readers' Service Item 26

Bulk material weigher

An instrument for weighing and metering dry flowing materials without interrupting flow is available from Industrial Processes, Inc. Designated the IPI dry-flow meter, it is intended to provide stream-flow data for automatic bulk processes. It is not a substitute for beam scales.

An electronic transducer translates unit weight of stream flow into electrical current. Then, optional instruments provide readings from local or remote stations, make permanent recordings of flow.

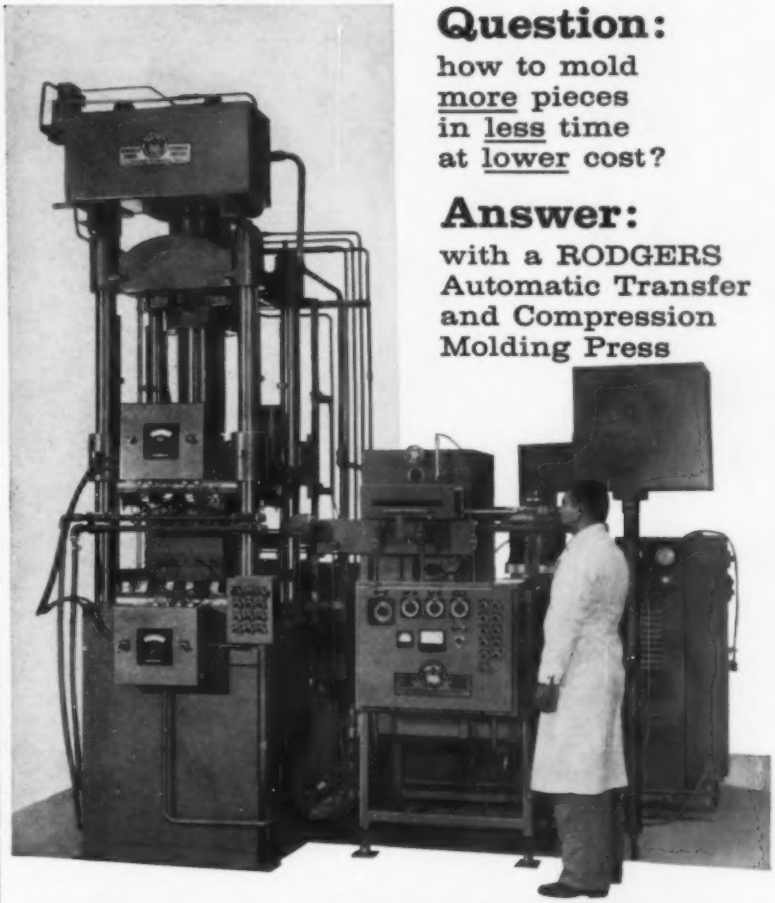
Readers' Service Item 27

Small capacity weigh feeder

A weigh-feeder with ten-ounce bucket capacity will deliver measured shots to small size injection molding machines. According to Exact Weight Scale Co., the weigh-feeder, when properly mounted on the press in place of a volumetric hopper, helps to save material, improve part quality, reduce cycle time, and minimize rejects.

The equipment consists of a scale, 50-pound spun aluminum supply hopper, and stainless steel net weight hopper and dump mechanism. Operating on electricity, it will deliver shots up to ten ounces.

Readers' Service Item 28



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more pieces
in less time
at lower cost?

Answer:
with a RODGERS
Automatic Transfer
and Compression
Molding Press

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PLASTIC
MOLDED
PIECES
...IN
LESS
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...AT
LOWER
COST

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2. **FLEXIBLE HYDRAULIC CONTROL**... gives precise speed and pressure for set-ups through rapid adjustment of relief valves.
3. **UNLOADER OPERATES AUTOMATICALLY**... operator never has to remove molded parts by hand.
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5. **2400 LBS. HOLDING FORCE**... parts held in desired portion of mold through pressure from positive-acting air cylinders. This reduces the number of springs needed, in some operations eliminates springs entirely.
6. **PROFITABLE PRODUCTION** is assured by all of these features, plus easy maintenance, quick accessibility to all components, floor-mounted pumping unit, accurate temperature controls, insulated platens, fully automatic pre-heater, and many other advantages which add up to *greater* production, in *less* time, at *lower* cost.

RODGERS molding presses are available in standard models of 100, 150, 200 and 300 tons. Send print, or part, and production requirements for recommended size, type of press, and accessories, to give you maximum profit.

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Now, for a minimum investment you can control your own production – produce blister packages, displays, 3-D letters, toys and many other vacuum-formed products. The Model 300A, illustrated, utilizes a wide range of thermoplastic materials – vinyls, styrene, polyethylene, butyrate, acetate, in sheets or rolls. No special training is required and changeover from one mold to another takes only minutes. You enjoy the flexibility that comes only with control of your own supply.

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WRITE FOR COMPLETE INFORMATION

PLAST-O-CRAFT CO., INC.
391 Mulberry Street, Newark, New Jersey
Mitchell 3-6760

Whitlock model 650 metering conveyor.

Metering mixer-conveyor

Whitlock Associates has introduced two metering conveyors which automatically mix color concentrate with natural material and convey the mixture to the machine hopper. The components are mixed in a predetermined ratio dependent on processing needs.

Model 600, with a rated capacity of 300 pounds of mixed material per hour delivered to machine hopper, operates on the plant air supply. Model 650, with a 400 pound per hour capacity, uses its own motor and blower unit, supplemented by a small amount of compressed air.

The conveyors meter volumetrically. Natural material is conveyed directly from shipping container to a receiving hopper on the conveyor. A second hopper stores the color concentrates. A full machine hopper is maintained. If either of the storage hoppers runs low, the conveyor stops to prevent unmixed materials from being delivered to the machine hopper.

The conveyors are adjustable for manual operation, so that the processor can determine the proper mixing ratio before putting the machine into automatic operation. The ratio can be adjusted from 6:1 to 25:1. Accuracy is reported to be high; according to tests, when the ratio is set for a 10:1 mix of natural to color concentrate, an accuracy of 2% is achieved.

Readers' Service Item 25

Electronic Heaters

Eastern Polymer Electronics Corp. has announced the availability of induction-hysteresis electronic heating equipment for plastic extruders, molding machines, and curing ovens. This cold coil equipment will fit most machines, since it is supplied in modular units.

Among the advantages claimed for using cold coil heating are speedy heating and low electricity consumption. Further, induction-hysteresis heaters automatically draw less wattage as the required temperature is reached. They are designed to outlast the life of extruder barrels.

Especially recommended for heating irregular or uneven surfaces, cold coils are easily installed in place of contact heaters. Variable wattage arrangements are stock; by changing connections on a standard coil, applied heat can be varied and different voltage inputs can be obtained.

Readers' Service Item 26

Screw Injection Machines

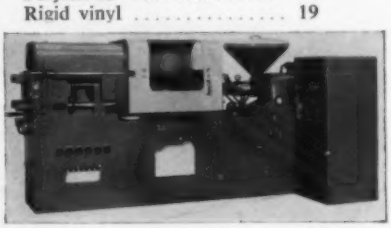
A complete line of reciprocating screw injection molding machines is now available from Ankerwerk International.

The reciprocating screw replaces the conventional torpedo cylinder and ram. The screw plasticizes and meters each shot, and then moves forward, injecting the shot into the mold cavity. While the molded part is being cooled and ejected, the screw retracts to receive and prepare the next shot. This system will accommodate all thermoplastic resins.

To facilitate changing color or type of material, the cylinder can be emptied merely by closing off hopper and continuing to operate screw. Injection and holding pressures can be automatically reduced during molding to prevent stress in the molded article.

Machine specifications for the two-ounce model V14-60 are:

Shot capacity with general purpose polystyrene	
A cylinder, 15,600 psi., oz.	1.1
B cylinder, 11,400 psi., oz.	1.7
C cylinder, 8,500 psi., oz.	2.3
D cylinder, 6,400 psi., oz.	3.0
Injection time for full volume, secs.	0.5
Maximum number of shots/hr.	1,600
Clamping pressure, tons	66
Opening pressure, tons	8.8
Optimum molded area, sq. in.	38
Maximum mold size, in.	11.8 x 5.5
Maximum stroke, in.	9.8
Drive, hp.	8.7
Floor space, ft.	9.3 x 3
Plasticizing capacities, lbs./hr.	
Polystyrene	42
Polycarbonate	35
Polyethylene	37
Polyamide	46
Rigid vinyl	19



Ankerwerk screw plasticizing machine.

Readers' Service Item 27

only 9720 lets vinyl makers DO BOTH

If you find yourself in the "cut cost — keep quality" squeeze (and who isn't these days), you can expect real help from Plastolein 9720. This is because 9720 contributes the quality characteristics of a polymeric, yet is the *lowest* cost polymeric available today.

9720 offers excellent permanence in terms of low volatility, low migration, and resistance to "wipe off," heat and ultraviolet light—which make it an ideal primary plasticizer for many formulations. And its ability to match the low temperature properties of many monomerics vastly widens the range of its uses.

Also—9720—which processes like most monomerics —is fluid enough to be handled economically in bulk.

All this explains why time-tested 9720 is the largest selling polymeric today. Why not let this talented low-cost performer take you out of the "cut cost—keep quality" squeeze. For complete details write Dept. Q-5 for booklet—"Plastolein Plasticizers."

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at the Plastics Show

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Carew Tower, Cincinnati 2, Ohio • Vopcolene Div., Los Angeles
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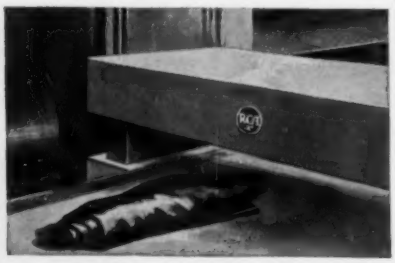
RCA Metal Detectors can quickly pay for themselves in your operation in longer machinery life, reduced downtime and increased profits. Get this protection at once. Write to RCA, Dept. U-410, Building 15-1, Camden, N.J.



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RADIO CORPORATION OF AMERICA

New Equipment (Cont'd.)

Vacuum forming machines

The Blist-O-Matic vacuum forming machine, a product of Comet Industries, incorporates automatic thermoforming and slitting to size at speeds of 6-10 cycles per minute. It is capable of forming and trimming items up to 5½ inches high and as small as a one-inch cube. Mold area is 24 by 32 inches.

After slitting, products are automatically removed from the table. Products may be formed by the plug assist, drape, cavity forming, and air form methods.

Readers' Service Item 29

Comet has also announced a die cutting press for trimming finished skin and blister packages. The press uses rule dies that permit rounded corners and pierced holes. It is available in two models—50-T with die space of 26 by 26 inches, and 75-T with die space of 36 by 42 inches. Capacities range from 50-75 tons; stroke is ¾-inch; maximum daylight is 13 inches; number of strokes per minute is 95.

Readers' Service Item 30

Pacific Plastic Machinery Inc. has developed equipment for vacuum, drape, and plug assist forming. Model V also provides three positions for skin packaging. Sheet can be fed manually for small runs, or automatically for production.

All functions are controlled by one eight-position switch. Limit switches, timers, and electrical switches plug in for easy repair or replacement. Sixteen-inch drape stroke is adjustable. Model V is supplied in four standard mold sizes—20 by 25 inches, 24 by 34 inches, 34 by 42 inches, and 42 by 72 inches—as well as to purchaser's specifications.

Readers' Service Item 31

Polyolefin film granulator

A rotary knife cutter for granulating polyethylene and polypropylene film in thicknesses of 1-3 mils has been developed by Sprout, Waldron & Co., Inc. Material cut on this machine is reported to have improved characteristics for flow and binning control.

The cutting area is 12 by 18 inches. Dimensions are 65⅝ by 25¾ inches Height is 20¼ inches with feeder, and 23¼ inches with feeder. The granulator is driven by a 30 hp. motor.

Readers' Service Item 32

Electric melting tanks

According to Aeroil Products Co., Inc., a line of wax melting tanks is also suitable for use with a variety of thermoplastics. The tanks are presently being used by electronics companies for dip coating critical parts prior to long term storage.

Available in capacities from five gallons to 295 gallons, all tanks feature a fusible link closing device for the cover (to reduce fire hazards), dial thermometer, automatic thermostatic controls, and full flow drain valve. Depending on the application, they may be used singly or in batteries. Temperatures run from 100-550° F.

Supplied with direct, immersion heating or indirect, oil bath heating, the tanks are manufactured in a wide variety of styles.

Readers' Service Item 33

Also worth mentioning

☐ A line of Howellseal epoxy encapsulated motors—two or three phase, 1-125 hp., ac., squirrel cage—has been announced by Howell Electric Motors Co. The motors are designed for open applications which usually required enclosed motors because of exposure to excessive heat, moisture, or corrosive materials.

Readers' Service Item 34

☐ J. D. Gould Co. has introduced a line of general service solenoid valves in eight sizes from ⅜-inch to 2½ inches. The two-way bronze valves, spring loaded for positive closing, vary in maximum pressure from 40-4 psi. Type MDW can be used on vacuum exhaust lines, drain lines, tank level and supply controls, etc.

Readers' Service Item 35

☐ Batch-type dielectric ovens for preheating plastics are available from Young Brothers Co. in several sizes. They are reported to minimize preheat time.

Readers' Service Item 36

☐ Model 610 vibratory finishing machine, a product of Lord Chemical Co., is designed for finishing small and delicate parts. The ¼-cubic foot capacity bowl, measuring 6 by 10 by 8 inches, will hold about 35 pounds of parts and media. Speed runs from 700-3,500 vpm.

Readers' Service Item 37

☐ Chemical machinery division of Baker Perkins, Inc., is offering a general purpose, vertical, planetary mixer for laboratory use. Believed to be the smallest of its kind, it can be used in a wide range of chemical compounds.

Readers' Service Item 38

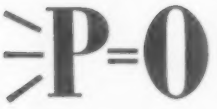
☐ For maintaining uniform flow of pulverized or granular dry materials, Tower Iron Works is supplying dry feeders. They are made with reinforced machined castings, corrosion resistant linings, and a channel base. Teflon wiper blades and heating or cooling jackets are optional.

Readers' Service Item 39

here are the facts on

PHOSPHATE and EPOXY

PLASTICIZERS FROM CELANESE



LINDOL: *Tricresyl phosphate, low color.* Low volatility, good resistance to extraction by oils, superior color. Standard for vinyls and cellulosics.

CELLUFLEX 179A: *Tricresyl phosphate, low specific gravity.* Lowest ortho content commercially available.

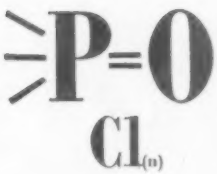
CELLUFLEX 179C: *Tricresyl phosphate, general purpose grade.* Excellent solvent power and flame retardance. Low volatility. For coatings and films demanding toughness and flame resistance.

CELLUFLEX 179EG: *Tricresyl phosphate, electrical grade.* To make plastic insulations. Offers flame resistance, outstanding electrical properties, low weight per unit volume.

CELLUPHOS 4: *Tributyl phosphate.* Plasticizer for resins and rubbers. Foam depressant. Selective solvent.

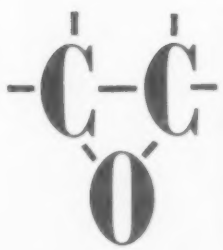
CELLUFLEX TPP: *Triphenyl phosphate.* Excellent fire resistance, good flexibility. Produces clear, tough compositions. Widely used for cellulose acetate.

CELLUFLEX 112: *Cresyl diphenyl phosphate.* High degree of flame resistance in vinyl formulations. Improved low temperature and light exposure properties.



CELLUFLEX CEF: *Tris beta-chloroethyl phosphate.* Exceptional flame retardance.

CELLUFLEX FR-2: *Tris dichloropropyl phosphate.* Exceptional flame retardance. Effective with wide variety of resins, both thermoplastic and thermosetting.



CELLUFLEX 23: *Alkyl epoxystearate.* Economical low-temperature plasticizer and stabilizer for polyvinyl chloride and other polymers. Very low volatility.

A thought to keep in mind—Celanese' shipment policies permit quick action to meet tight schedules. We ship from convenient points throughout the United States. We'll be glad to provide you with specifications on any of these plasticizers. For more information, write to: Celanese Chemical Company, a Division of Celanese Corporation of America, Dept. 564-E, 180 Madison Avenue, New York 16, N. Y.

Celanese® Lindol® Celluflex® Celluphos®

Canadian Affiliate: Canadian Chemical Company, Limited, Montreal, Toronto, Vancouver
Export Sales: Amcel Co., Inc., and Pan Amcel Co., Inc., 180 Madison Avenue, New York 16, N. Y.

Plastics Applications

Foam core building panels

Foam core building panels have been adapted for the farm building field by Wood-Fab, Inc. The company's Dri-Lite panels, surfaced with plywood or fibreboard, have a core foamed of Dylite expandable polyestyrene, a product of Koppers Co., Inc.

These standard size panels can be assembled on a mass production basis. Of tongue and groove overlap type, the panels can be fitted together easily. Nails are needed only where panels are joined together and to the frame. They may be used for walls and roof, with plywood surfaces on the walls and fibreboard for the roof.

Readers' Service Item 41

Coal processing chutes

Linear polyethylene chutes for anthracite processing plants are currently undergoing extensive testing at several Pennsylvania coal plants. According to Abutco Plastics Industries, Inc., who manufactures chutes, liners, and buckets from Celanese Corp.'s Fortiflex linear polyethylene, polyethylene chutes are being considered as replacements for all steel chutes in one plant.

The prime advantage of the polyethylene is that it resists corrosion by the acids which are present when coal is mixed with water. Further, it weighs only one-eighth as much as the steel it replaces. These two characteristics lead to savings in installation as well as in maintenance and replacement costs.

Besides being used in chutes, polyethylene is fabricated into liners for coal storage bins and trucks. The industry is also experimenting with polyethylene buckets on coal conveyor belts. All three types of equipment are manufactured from extruded sheets which are cut, bent, or formed into the desired design.

Readers' Service Item 42

For more information check Readers' Service Card (p. 131)

Thermolite® ORGANOTIN stabilizers

Used alone for unmatched performance in optical clears, or synergistically to greatly boost the stabilization characteristics of less effective stabilizers.

Thermolite Organotins are the first choice for premium crystal clarity in PVC—and are often the successful last resort when other stabilizers fail under difficult processing conditions.

FOR ULTRA-HIGH TEMPERATURE STABILITY
in the processing of rigids and semi-rigids

Thermolite 35 and Thermolite 36—These new unique stabilizers are the most powerful known for PVC.

Thermolite 31—Processing at 350 F and above is practical with this stabilizer...the standard stabilizer for heat stability in clear or pigmented rigids.

Thermolite 20—Lubrication is built into the molecule of this organotin. For use alone or with Thermolite 31, as lubrication requirements dictate.

FOR VERY-HIGH TEMPERATURE STABILITY

Thermolite 13—Outstanding light stability and excellent heat stability are contributed by an organotin-dienophilic combination in the molecular structure. Particularly suitable for plastisols, rigids, semi-rigids and blending with other Thermolites.

Thermolite 17—Combines the heat stability of the dienophilic Thermolite 13 with the high-lubrication of Thermolite 12. An ideal stabilizer for calendering and extrusions.

Thermolite 12—Outstanding light stabilization and excellent lubrication augment good heat stability. These properties plus ready solubility in plasticizers make it unusually useful for plastisols and organosols.

FOR ALL-PURPOSE ORGANOTIN STABILIZATION

Thermolite 25—Widely used in plastisols because of its excellent heat and light stability and is especially valuable in slush molding where it gives no plate-out problems.

Thermolite 26—A self-lubricating stabilizer with good heat and light stability, especially recommended for calendering vinyl copolymers.

CATALYSTS Urethane Foam

A complete line of one-shot foam catalysts, including:

M&T Catalyst T-9—A unique stannous catalyst that retains its catalytic activity for superior, uniform foams.

M&T Catalyst T-18—A stannous type that helps minimize foam softening.

M&T Catalyst T-8 (Dibutyltin di-2-ethylhexoate) and **M&T Catalyst T-12**—These organotins have been widely used, frequently in combination.

M&T Dibutyltin Diacetate—A specialized catalyst used in sprayable rigids.

M&T Catalyst T-27—A new catalyst for spraying formulations. Gives fast rising and excellent package stability in resin premixes.

Stannous Octoate (Stabilized)

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Thermolite® Ba-Cd stabilizers

A unique, new concept in Ba-Cd stabilizers for low-cost processing clarity and outstanding light stabilization.

Thermolite 112—A completely aromatic-based, low-volatility stabilizer giving crystal clarity and excellent light stability. Soluble in all plasticizers this Ba-Cd stabilizer overcomes plate-out in calendering extrusions.

Thermolite 116—A superior high-heat-stability stabilizer which also provides excellent light stability for clear and pigmented compounds.

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...For incorporation in PVC and other chlorine-containing films and coatings to provide "non-inflammable" characteristics.

M&T Thermoguard® H—High tinctorial strength antimony oxide for whites and pastels where it contributes useful white-tinting strength.

M&T Thermoguard® L—Low tinctorial strength antimony oxide; a minimum opacity antimony oxide particularly suitable for deeper colors.

M&T Flame Retarder—An antimony-based flame retarder that has one-fifth the tinting strength of antimony oxide and designed for semi-transparent plastics or those containing high-cost pigments and toners.

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Plastics Applications (Cont'd.)

Plexiglas lighting fixtures installed by Wagner-Woodruff Co.

Acrylic light globes

A group of plug and ring formed Plexiglas light globes, produced by Ray Products, Inc., has been installed in a Beverly Hills savings and loan office. The 48-inch diameter globes were made on a recently installed press which will form items up to 48 by 60 inches, and 25 inches deep. The plug and ring technique was used to insure symmetry and freedom from distortion.

Each globe suspended from the second floor ceiling has a one kilowatt mercury vapor fixture mounted in the top, just above a reflector. The fixtures indirectly illuminate the room. Additional illumination is furnished by four fluorescent lamps inside each globe.

Readers' Service Item 43

Toy automobile body

The body of the Kiddybird 60 toy automobile now is vacuum formed from Cycolac ABS resin. This durable material provides a body with rigidity, toughness, and weather resistance, desirable characteristics for a plaything which may be subjected to rather rough treatment.

According to Hamilton Steel Products, Inc., producer of the Kiddybird, the low cost tooling of the vacuum forming dies permits relatively inexpensive design changes. The yellow 1961 model, 50 inches long and 21 inches wide, features simulated lights on its rear fins and a molded-in wraparound front bumper. Mounted on a steel frame, the car weighs 43 pounds.

Cycolac resin is supplied by Marbon Chemical Division of Borg-Warner Corp.

The Kiddybird 60.

Readers' Service Item 44

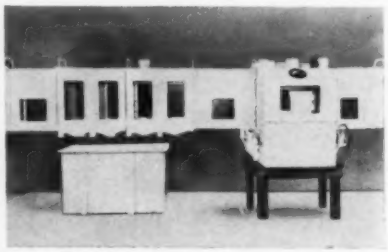
Polyester Etching Machine

An automatic machine for etching printed circuit plates at RCA, Camden, N. J., is composed almost entirely of fiberglass-reinforced polyester.

One of the requirements of the system was that it be resistant to corrosion by cupric chloride etching solution. The previous installation, PVC-coated steel, had been corroded by the acid. The polyester system, fabricated by Indust, Inc., is claimed to withstand the cupric chloride.

Essentially, the system consists of a vestibule, etching tank, and series of chambers where etched plates are drained, rinsed, redrained, and dried. Plates are conveyed through the process by an overhead chain. Twenty-four rotating polyester paddles toss the cupric chloride into the air to coat the plates as they pass through.

The system uses polyester resin even for assembly details which are machined to close tolerances, such as stuffing boxes for drive shafts. Such items as stainless steel core drive shafts are also coated with resin and machined to size.



Fiberglass-polyester etcher for circuit plates.

Readers' Service Item 45

Reinforced acrylic panels

Translucent, fiberglass reinforced acrylic panels are the first end products to be manufactured by Owens-Corning Fiberglas Corp. Designed for roof and sidewall lighting, and other industrial and commercial applications, the panels are bonded with 100% Lucite acrylic resin developed in cooperation with Du Pont.

The laminate consists of three layers. The acrylic bonding resin is combined with one heavy center ply of reinforcing mat and a ply of surfacing mat on each face of the panels. Both resin and laminate structure are reported to provide superior lighting as well as outstanding weather resistance.

Fiberglas daylighting panels are available in two shades each of white and green, ranging in light transmission values from 80-60%.

Readers' Service Item 46

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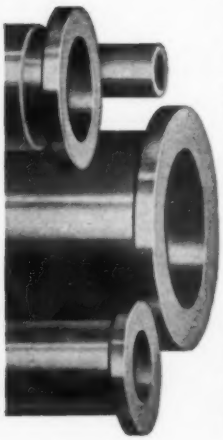
meets every requirement in extruder cylinders



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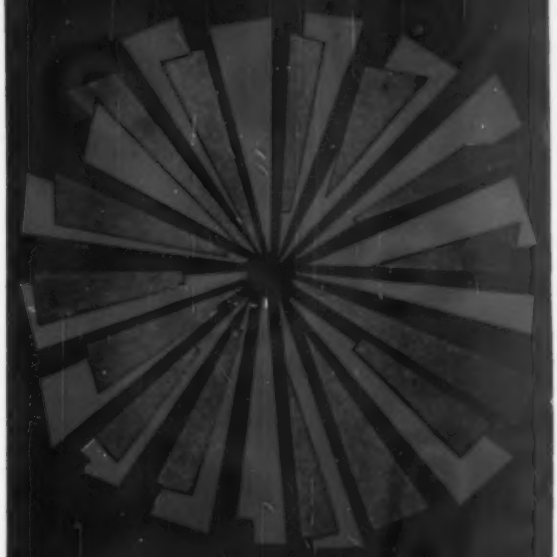

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Never-Sink mooring buoy.

Foam core mooring buoy

The Never-Sink buoy, manufactured by Navesink Laminating Ltd., consists of a fiberglass-reinforced shell enclosing a foamed-in-place, rigid urethane interior. Produced in highly visible white and orange, the buoy can be easily spotted. Life expectancy is estimated at eight years.

Because of the core of Nopco Lockfoam, the buoy will not sink even if punctured or damaged.

Readers' Service Item 47

Glass-fluorocarbon seals

Oxygen regulators for hospital and medical applications manufactured by Air Reduction Sales Co. are equipped with seals made of a glass-filled halo-fluorocarbon plastic. The seals, which consists of Kel-F resin with a 15% micropulverized glass filament reinforcement, are reported to show outstanding resistance and durability in applications where the oxygen becomes rarefied at high pressures. They have a Rockwell M hardness of 55-60.

Molded by Fluorulon Laboratories, Inc., of Minnesota Mining and Mfg. Co.'s material, the seals will retain density and chemical inertness at high pressures and temperatures to 425°F.

Readers' Service Item 48

Plastic drink sippers

Plastic drink sippers designed for sickroom use have been made available by Sunlite Plastics, Inc. Extruded from Dow Chemical Co.'s medium density polyethylene 663E, the sippers can be bent to any angle and will snap back to their original shape. They are designed to retain their shape during repeated washing and sterilization.

The material from which Suni-Sip sippers are extruded is odorless, tasteless, and non-toxic. It is generally suitable for food contact applications.

Readers' Service Item 49

Durable bearing material

A reinforced plastic bearing material designated Fabroid is reported to be unmatched for high unit load, long-life, low-friction, high temperature bearing applications. Designed and produced by Micro-Precision division, Micromatic Hone Corp., Fabroid is a fabric woven of both fibrous glass and Teflon fibers, and backed up by a second fabric of glass cloth impregnated with phenolic. The glass-phenolic system acts as a lattice work, restraining the Teflon from cold flowing.

In journal bearing applications, a phenolic molding compound is necessary to support the Fabroid bearing elements. Durez 16771, a development of Durez Plastics division, Hooker Chemical Corp., was selected because it could be transfer molded, could provide a good bond between itself and the fabric, and could resist heat, oils, and other materials and atmospheric elements. In producing journal bearings, Fabroid cut to size is placed in a transfer molding die, and phenolic is transfer molded around it.

Fabroid's two main features are exceptionally high load carrying capacity and long life. Use of Fabroid bearings is thus far limited to high unit load, low velocity applications. Most applications to date have been on aircraft control units, particularly for helicopters.

Readers' Service Item 50

Flexible PE container

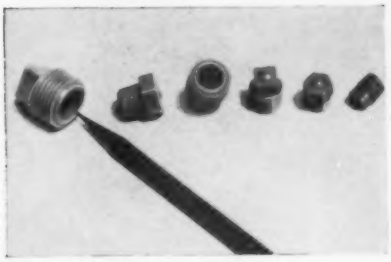
Associated Plastics, Inc., is manufacturing a flexible, five-gallon, polyethylene container named Flex-O-Boy. Designed for economy of transportation and warehousing when empty, the containers can be used for shipping alkalis, battery acids, syrups, and other chemicals and foodstuffs.

Flex-O-Boy polyethylene jugs.

Readers' Service Item 51

Acetal pipe plug

Russell, Burdsall & Ward Bolt and Nut Co. has introduced a Delrin pipe plug which is claimed to seal tightly without sealing compound and not to loosen under vibration. Since the plugs are hollow, pressure forces plug threads tighter against mating threads, thus increasing sealing ability. In pressure tests, the plugs have



Delrin pipe plug

withstood from 3,000-10,000 psi. Loosening torque exceeds tightening torque.

Primary applications are in such products as compressors, pumps, gas and water meters, fuel pumps, appliances, and air conditioners. Delrin plugs can be used with all types of organic fluids.

The plugs are injection molded from Du Pont's Delrin by Industrial Plastic Molders, Inc. They are available in square heads (⅛, ½, ⅜, and ½ inch) and hex heads (⅛ and ¼ inch).

Readers' Service Item 52

Automatic Blister Packager

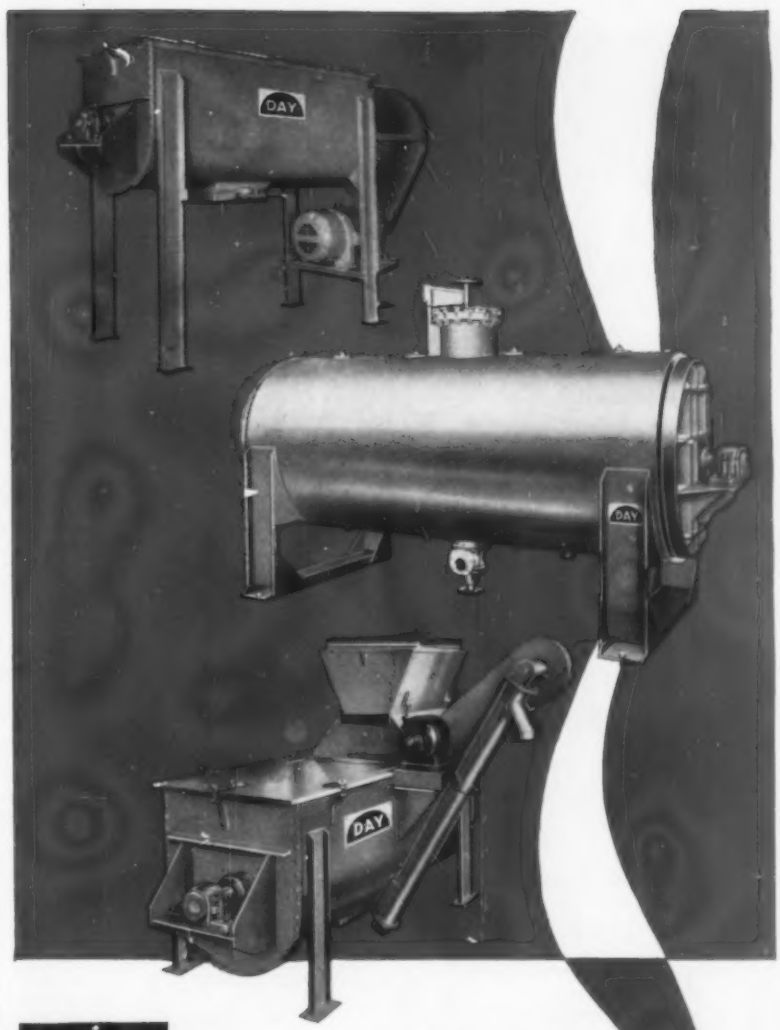
Jackmeyer Corp. has developed an air press for mass production of blister packages for almost any type, size, and shape of product. Because of Jackmeyer's stik-on process, the machine operates without heat and with a minimum pressure requirement.

Lack of heat means that the press will not damage the card or packaged item. By running on only 5-10 pounds of pressure, the machine is safe for delicate or sensitive parts.

The press is geared to produce one seal per second. The operator inserts the blister in the jig, drops the product in the cavity, and places the card over the blister. A turret table accommodating several cards can be used to increase production.

Jackmeyer heatless blister package machine

Readers' Service Item 53



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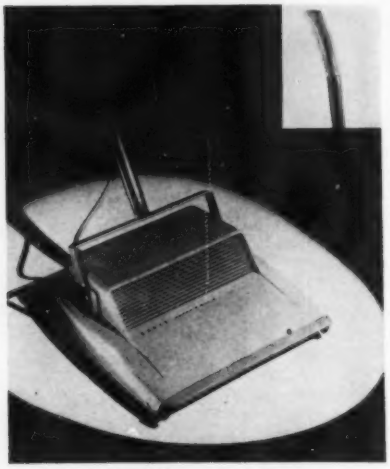

Davis Sweep O Matic.

Electric carpet sweeper

The Sweep O Matic electric rug and carpet cleaner has been introduced by Davis Manufacturing Co. Whisking mechanism and motor are housed in a case compression molded from a phenolic molding compound supplied by Durez Plastics Division, Hooker Chemical Co. Durez 791 reportedly provides an even surface finish without flow lines, assuring an excellent base for subsequent spray finishing with a decorative and protective paint.

A wide rubber strip on the front of the case permits use in areas hard to reach and in cleaning floor surfaces close to walls without marring paint.

Readers' Service Item 54

Also Worth Mentioning—

☐ A new grade of flame retardant Insurok laminate has been introduced by Richardson Co., Grade T-777, a paper based, phenolic laminate available with or without copper cladding, is claimed to possess good electrical properties, dimensional stability, and punching qualities. It is recommended to the radio, television, electrical, and electronic components industries.

Readers' Service Item 55

☐ Pilot production of Synthamica 202 synthetic mica paper has been announced by Synthetic Mica Co. For use in high temperature transformers, motors, and capacitors, the material has a melting temperature of 1,365° C., and an operating temperature up to 1,000° C. Its electrical and mechanical properites also recommend it for electronic components.

Readers' Service Item 56

☐ Revell, Inc., has come up with another Dr. Seuss game, this one based on the book, "Yertle the Turtle." Twenty-one Yertles molded of Grex high density polyethylene must be balanced on a small tumbler and then removed. Rules can be devised by the players.

Readers' Service Item 57

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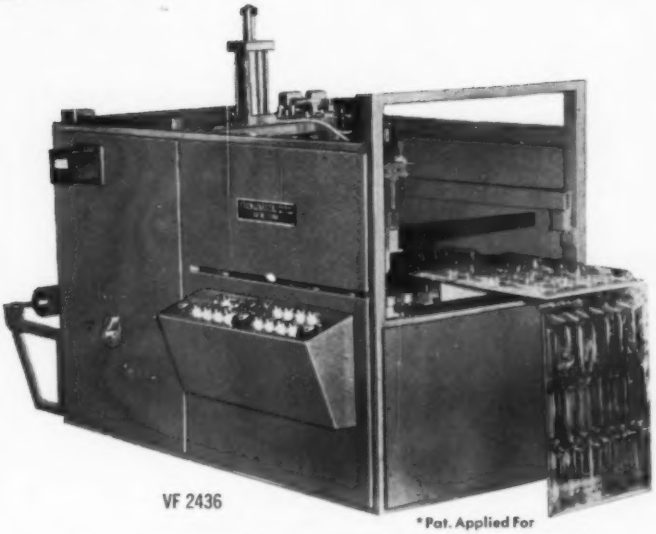

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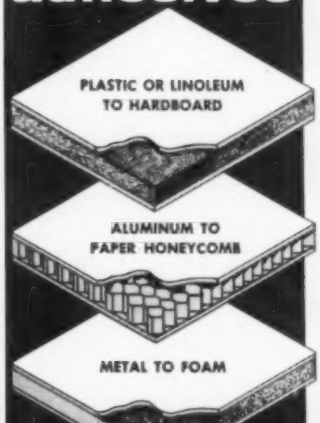

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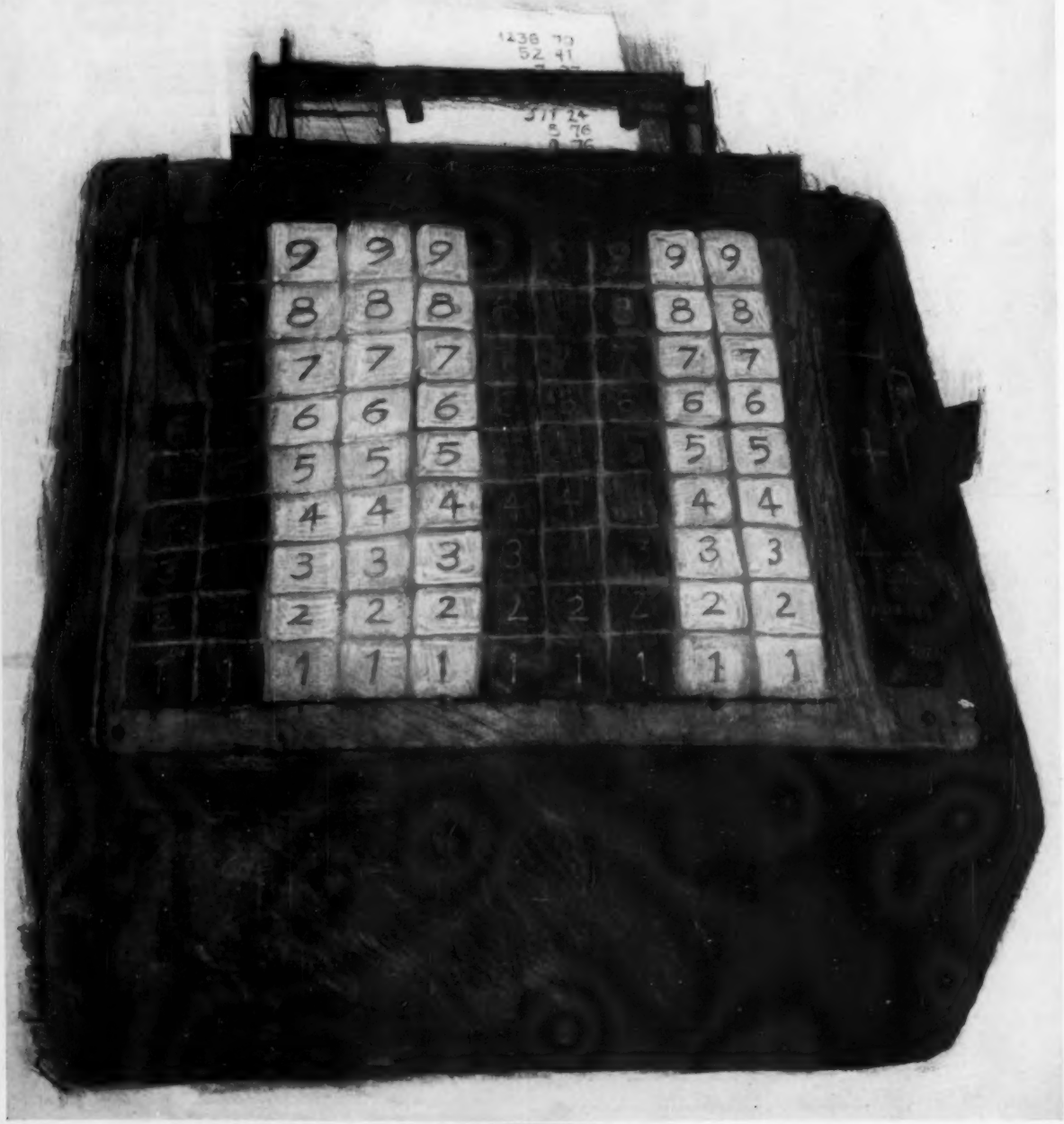

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New Literature

For more information check Readers' Service Card (p. 131)

"Alfa Universal Automatic Cutting Machines." Catalog 1160. Alfa Machine Co. 12 pages. Flow diagrams and photographs supplement the text explanation of the specialized conditions to which these machines can be adapted. The catalog covers idler rolls, feed drives, feed means and control, measurement, and take-away means.

Readers' Service Item 61

"Union Carbide Silicones." Union Carbide Corp. 16 pages. Describes nature, uses and possibilities of silicones. Charts cover properties and features of fluids, resins, compounds, water repellents, antifoams, and emulsions.

Readers' Service Item 62

"Teflon Piston Ring Seal." Bulletin TF-010. Tetrafluor, Inc. 4 pages. Details construction, advantages, and applications of Teflon piston ring seals and micro-leak Teflon piston ring seal sets. Tabulates O.D., wall, and thickness of standard piston ring seals.

Readers' Service Item 63

"Glass-Bonded Mica for Crucial Insulator Applications." Electronic Mechanics, Inc. 12 pages. Outlines uses of Mykroy glass-bonded mica, with engineering sketches and data. Tabulates properties of sheet and rod, and compression and transfer molded specimens.

Readers' Service Item 64

"Halby DL-TDP and TDPN." Bulletins 101 and 106. Halby Products Co., Inc. 2 pages. The bulletins describe DL-TDP (B,B′ dilauryl thiodipropionate), a stabilizer for polypropylene and a plasticizer; and TDPN (B,B′ thiodipropionitrile), which finds application as a plasticizer for elastomers, in the synthesis of edible polyolefin stabilizers, and in the preparation of linear polyamides.

Readers' Service Item 65

"Model 475 Overwrapping Machines." Battle Creek Packaging Machines, Inc. 4 pages. This brochure illustrates nine machines for overwrapping, and lists the purposes for which each was designed. Dimensions, film specifications, speed, etc., are covered.

Readers' Service Item 66

"Sweco Vibro-Energy Separators and Case Histories." Catalog and bulletins SS-103, SS-95, and SS-92. Southwestern Engineering Co. 23 pages. The case histories show how screening problems in processing were solved. In three instances, involving processing of vinyl, phenol formaldehyde resin, and diced polyethylene, use of vibratory separators improved quality control. The catalog explains the use of separators in several industries, and provides illustrations and specifications of models.

Readers' Service Item 67

"The Why and How of International Standards." American Standards Association. 12 pages. The booklet explains the necessity for international standards, and outlines what ISO and IEC are doing toward setting up and spreading such standards.

Readers' Service Item 68

"Maraglas Crystal Clear Thermosetting Resin." Technical Bulletin #655. Marblette Corp. 2 pages. Methods of preparing rigid, high impact, and flexible castings from transparent epoxy. Properties, applications, and methods of release.

Readers' Service Item 69

"Polystyrene Product Data Guide." Rexall Chemical Co. 4 pages. This guide describes Elrex 100, 200, and 500 series of polystyrenes, giving significant property ranges for each formulation. Series 100 is general purpose; 200, improved flow; and 500, high impact.

Readers' Service Item 70

"Stevens Fiber Glass Fabrics for Industry." J. P. Stevens & Co., Inc. 34 pages. A comprehensive general information and specification brochure listing widely used constructions of fiberglass fabrics, woven rovings, and tapes for industry.

Readers' Service Item 71

"Olsenmark Power Presses." Olsenmark Corp. 4 pages. Specifications and photographs of stripped power presses in sizes of ½-7 tons. Can be used for almost any finishing operation other than hot stamping with addition of heating heads, controls, etc., depending upon the job.

Readers' Service Item 72

"Digest Catalog." Bulletin 60-2. Hoffman Valves, Inc. 4 pages. Chart of poppet type valves, coordinated with air and solenoid pilot operators. Cutaway drawings show construction, sealing arrangements, poppets, and flow patterns.

Readers' Service Item 73

"Application Data Sheet." No. P-8072. Beckman Scientific and Process Instruments Division. 2 pages. Discusses different kinds of density, e.g., substance density and particle density. Reports on determination of volume, density, and porosity through use of the Model 930 air comparison pycnometer.

Readers' Service Item 74

"This is Delrin Acetal Resin." No. A-18404. Polychemicals Department, E. I. du Pont de Nemours & Co. 24 pages. Characteristics are explained in figures and tables. After summarizing properties, the brochure discusses designing, molding, and fabricating procedures. It concludes with several case histories.

Readers' Service Item 75

"Machining and Fabrication of Nylux." Bulletin No. W-10. Westlake Plastics Co. 4 pages. Data on extrusion, annealing, and moisture conditioning nylon rod, sheet, and tubing. Verbal and pictorial instructions for sawing, turning, drilling, reaming, milling, and threading and tapping extruded material.

Readers' Service Item 76

"Plastic-Coated and Laminated Packaging Materials." Marvellum Co. This file folder contains samples of Marvelene polyethylene coated papers. The folder features data on applications and processing.

Readers' Service Item 77

"Textolite Industrial Laminates." L-CDL-514. Laminated products department, General Electric Co. 16 pages. This catalog lists 39 grades of copper-clad, sheet, tubing, and rods. Information on rolled and molded tubing, insulation, and printed circuit applications. Properties, tolerances, and thickness ranges.

Readers' Service Item 78

"The Story of Bjorksten Research Laboratories." Bjorksten Research Laboratories. 14 pages. Describes organization, activities, working arrangements, facilities, personnel, and areas of research. Included in the latter is research in organic and polymer chemistry.

Readers' Service Item 79

"Spray Dryers for Pilot Plant and Moderate Production." Bulletin #37. Bowen Engineering, Inc. 4 pages. Provides information on capacity and specifications of air heating, chamber sizes and construction, atomization, duct arrangement, product collection, and accessory instrumentation. No. 2 spray dryer is for moderate production up to 10 tons per day; No. 4, for up to 20 tons per day.

Readers' Service Item 80

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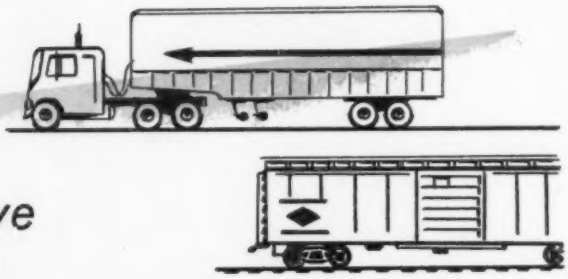

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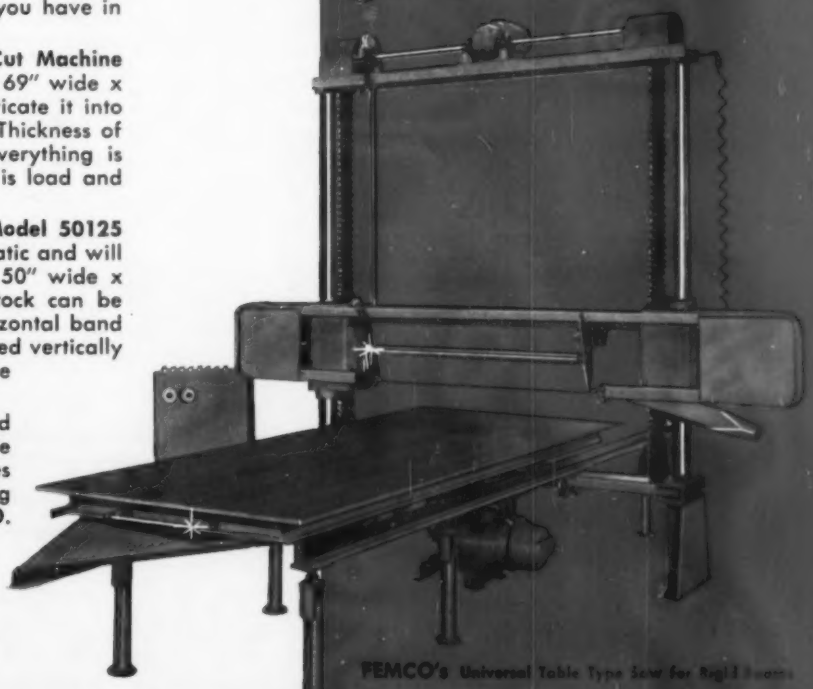

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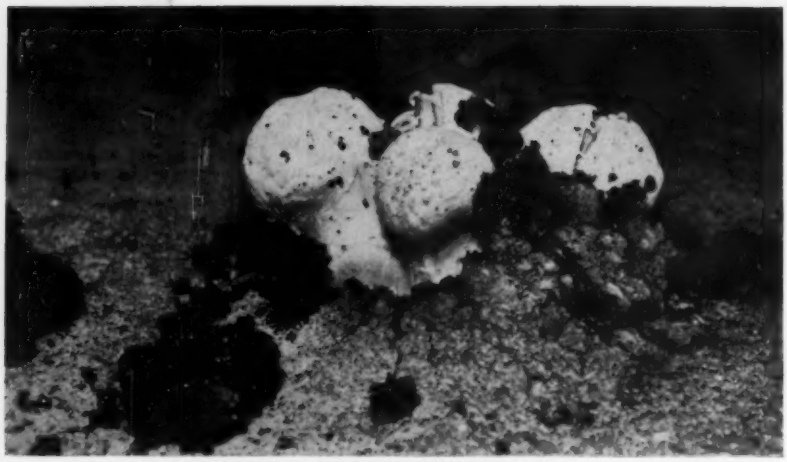

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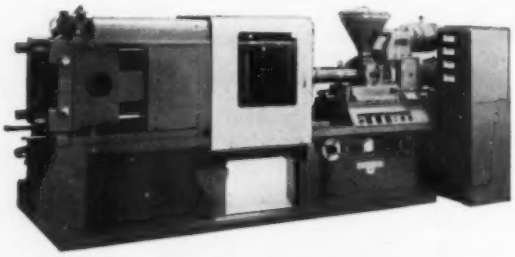

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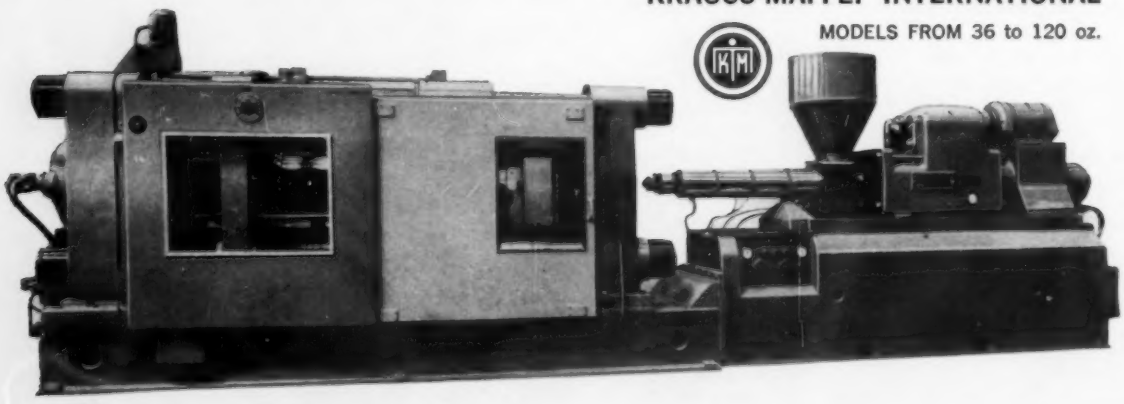

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Patent Digest

Materials

Preparation of Polyurethane Resin Foams Using Mixtures of Tertiary Amines and Acid Anhydrides as Catalysts. No. 2,957,831. E. E. Parker, Allison Park, Pa. (to Pittsburgh Plate Glass Co.).

Cellular Polyurethane Elastomer and Preparation of Same Using Pyridine Catalyst. No. 2,957,832. G. T. Gmitter and E. M. Maxey, Akron, O. (to General Tire & Rubber Co., Akron, O.).

Dry, Free-Flowing, Pigmented Polyvinyl Chloride Composition and Method of Making. No. 2,958,669. E. D. Hoffman, Baltimore, Md. (to Western Electric Co., Inc., New York, N. Y.).

Stabilization of Chloro-Polymers Against Thermal Degradation. No. 2,959,566. (B. E. Burgert and R. L. Hudson, Midland, Mich.).

New Asymmetric Polyamides. No. 2,959,572. J. A. Blanchette, E. Longmeadow, Mass. (to Monsanto Chemical Co., St. Louis, Mo.).

Pentafluorobutadiene Copolymers. No. 2,959,575. E. S. Lo, Fords, N. J. (to Minnesota Mining & Mfg. Co., St. Paul, Minn.).

Heat Stabilized Vinyl and Vinylidene Chloride Polymer. No. 2,960,491. P. K. Isaacs, Brookline, A. Trofimow, Cambridge, and D. M. Wacome, Lexington, Mass. (to W. R. Grace & Co., Cambridge, Mass.).

Process for Inhibiting Cross-Linkages in Polyethylene by the Use of Alkylated Hydroxyanisoles or Substituted Phenyl Amines. No. 2,960,496. R. O. Eler, Wilmington, Del. (to E. I. du Pont de Nemours & Co., Wilmington, Del.).

Modified Polyamide Resins. No. 2,956,-986. G. Swann, Woolton, and P. G. Evans, Liverpool, England (to Beck, Koller & Co., Ltd., Liverpool, England).

Composition for Making Odorless, Non-Exuding Vinylidene Chloride Copolymer Film. No. 2,956,969. C. B. Havens, Hope, Mich. (to Dow Chemical Co., Midland, Mich.).

Polyvinyl Resin Composition Containing Plasticizer and Stabilizer. No. 2,956,975. F. P. Greenspan, Williamsville, N. Y. (to Food Machinery and Chemical Corp., San Jose, Calif.).

Composition Comprising Polyethylene and an Alkylol Amide. No. 2,956,979. S. P. Rowland, Cincinnati, and H. Braus, Springdale, O. (to National Distillers and Chemical Corp.).

α-Chloroacrylic Acid Ester Compositions and Method of Producing Shaped Articles Therefrom. No. 2,956,049. H. D. Anspon, Easton, and F. E. Pschorr, Phoenixville, Pa. (to General Aniline & Film Corp., New York, N. Y.).

Ethylene Polymerization Process and Catalyst Therefor. No. 2,956,050. C. J. Benning, Densington, Md. (to W. R. Grace & Co.).

Formation of Rod Stock from Thermoplastic Materials. No. 2,962,760. R. G. Alsup, Wilmington, Del., P. E. Lindvig, Boothwyn, Pa., and J. H. Miller, Newark, Del. (to E. I. du Pont de Nemours & Co., Wilmington, Del.).

Thermoplastic, High Melting Polyspiranes. No. 2,963,464. S. M. Cohen, Springfield, and E. Lavin, Longmeadow, Mass. (to Shawinigan Resins Corp., Springfield, Mass.).

Stabilizing Halogenated Copolymers by Adding the Stabilizers Before Compounding and Curing the Copolymers. No. 2,964,493. T. H. Hakala, Union, and J. J. Laffey, Elizabeth, N.J. (to Esso Research and Engineering Co.).

Stabilized Poly-α-Olefin Compositions. Nos. 2,964,495, -496, -497. (to Eastman Kodak Co., Rochester, N.Y.).

Heat-Hardenable Compositions Composed of Polyvinyl Chloride, Epoxy Resin and Hardening Agent, Cellular Product and Method of Preparing Same. No. 2,965,586. W. Fisch, Binningen, R. Hiltpold, Basel, and H. Batzer, Arlesheim, Switzerland (to Ciba Ltd., Basel, Switzerland).

Method of Curing Plasticized Polyvinyl Chloride Using Radio Frequency Electrical Energy. No. 2,966,469. W. J. Smythe, Ridgewood, N.J., E. M. Muller, Hastings on Hudson, N.Y., and R. W. Weeden, Pompton Lakes, N.J. (to Union Carbide Corp., New York, N.Y.).

Stabilized Polypropylene. No. 2,967,-169. P. E. Oberdorfer, Jr., Claymont, Del. (to Sun Oil Co., Philadelphia, Pa.).

Linear Polyester-Polyurethane Product and Process of Preparing Same. No. 2,962,470. S. L. Jung, Wilmington, Del. (to E. I. du Pont de Nemours & Co., Wilmington, Del.).

Printed copies of patents are available from the Commissioner of Patents, Washington 25, D. C. Prices, 25c each.
—The Editor

Equipment

Apparatus for Forming Composite Extruded Articles. No. 2,962,786. E. A. Hawk, Sr., and E. A. Hawk, Jr., R.D. 1, E. Rochester, O, and P. P. Marchiano, Box 62, Malvern, O.

Apparatus and Method for Encapsulation of Magnetic Cores. No. 2,962,803. J. P. Jones, Pottstown, Pa. (to Burroughs Corp., Detroit, Mich.).

Thermoplastic Welding Device. No. 2,963,072. H. D. Swartz, 101 Verndale St., Brookline, Mass. (one-fourth to G. Altman, Newton, Mass.).

Copolyesters. No. 2,965,613. C. R. Milone, Chillicothe, M. C. Shaffer, Akron, and F. S. Leutner, Cleveland Heights, O. (to Goodyear Tire & Rubber Co., Akron).

Linear Polyamides from Aliphatic Dicarboxy Compounds and Aliphatic Diamines Upgraded with Trans-1,4-Cyclohexane-Dicarboxylic Acid. No. 2,965,616. J. R. Caldwell and R. Gilkey, Kingsport, Tenn. (to Eastman Kodak Co., Rochester).

Take-Off Mechanism for Plastic Mills. No. 2,962,753. A. Hale, Akron, and C. L. Conley, Jr., Cuyahoga Falls, O. (to Blaw-Knox Co., Pittsburgh, Pa.).

Machines for Furnishing Electric Wires with a Multi-Colored Plastic Covering. No. 2,962,756. J. Biche and L. Andouart, Paris, France (to Le Materiel de Cablerie, Courbevoie, France).

Heating Cylinders for Injection Molding Machines. No. 2,962,759. M. Maccaferri, Rye, N.Y.

Centrifugal Molding Apparatus. No. 2,961,703. A. D. Pinotti, Toledo, O. (to Kimble Glass Co.).

Injection Machine. No. 2,961,704. C. S. White, 30007 Lahser Rd., Birmingham, Mich.

Method and Apparatus for Packaging Fluid Molding Material. No. 2,961,705. G. W. Wacker, 4762 Reading Rd., Cincinnati 37, O.

Bleed Back with Loose Mandrel for an Injection Molding Machine. No. 2,961,706. G. C. Swenson, 310 Arbuckle Rd., Erie, Pa.

Method of Producing Rimmed, Labeled, Plastic Spools. No. 2,961,715. L. H. Morin, Bronx, N.Y. (to Coats & Clark, Inc., New York, N.Y.).

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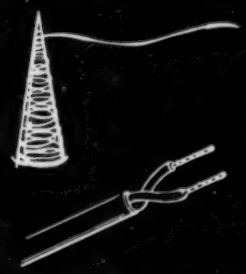

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Patent Digest (Cont'd.)

Method of Sealing the Bore of a Stator Structure by Extruding a Liner and Subjecting the Liner to Centrifugal Force While Curing. No. 2,961,716. F. O. Luenberger, Los Angeles, Calif. (to U.S. Electrical Motors, Inc., Los Angeles, Calif.).

Injection Molding Machines. No. 2,965,-929. S. C. H. Smith, Surbiton, England (to R. H. Windsor Ltd.).

Apparatus for Making a Protective Cap Structure for a Grease Fitting and the Like. No. 2,966,701. R. M. Heller, Birmingham, Mich. (to Watts Electric & Mfg. Co., Birmingham, Mich.).

Method of and Apparatus for Making Plastic Articles. No. 2,966,702. L. D. Soubier, Toledo, O. (to Owens-Illinois Glass Co.).

Method of Making a Composite Tube Structure. No. 2,966,703. J. B. Harmon, Royal Oak, Mich. (to Watts Electric & Mfg. Co., Birmingham, Mich.).

Mould for Hot-Pressing Thin Flat Articles. No. 2,961,699. P. R. Dijksterhuis and J. C. van Houten, Baarn, Netherlands (to North American Philips Co., Inc., New York, N.Y.).

Extrusion Mill Assembly. No. 2,961,700. E. N. Meakin, 372 Roblar Ave., Hillsborough, Calif.

Extrusion Apparatus. No. 2,961,701. J. R. Hannold, Radnor, Pa. (to Welding Engineers, Inc., Norristown, Pa.).

Adjustable Extrusion Die. No. 2,963,-741. M. O. Longstreth and J. E. Tollar, Midland, Mich. (to Dow Chemical Co., Midland, Mich.).

Film Tube Guide. No. 2,963,742. H. G. Ahlich and J. L. Amox, Midland, Mich. (to Dow Chemical Co., Midland, Mich.).

Film Sealing Mechanism for Packaging Machines. No. 2,963,838. J. W. Harrison, Winchester, and J. N. Welch, Walpole, Mass. (to W. R. Grace & Co., Cambridge, Mass.).

Manufacture of Synthetic Linear Polymers. No. 2,964,391. R. W. H. Benson, Harrogate, England (to Imperial Chemical Industries, Ltd., London, England).

Plastic Molding Apparatus. No. 2,964,-789. F. E. Conder, 2507 Valley Ave., Marion, Ind., and B. W. Gibson, 3750 S. Adams St., Marion, Ind.

Rotary Molding Machines. No. 2,965,-923. M. M. Smith, Yardley, Pa., and T. M. Knowland, Belmont, Mass. (to American Biltrite Rubber Co., Inc., Chelsea, Mass.).

Extrusion Machines. No. 2,965,926. V. A. von Haase, Rocky River, O. (to Von Machine & Mfg., Inc., Rocky River, O.).

Article Abstracts

Materials

"Migration of Lead from Lead-Stabilized PVC Pipes," H. Niklas, KUNSTSTOFFE, 51, 1, 2 (Jan. 1961).

Investigations show that PVC pipes can safely be used to convey drinking water as long as they are adequately rinsed before use and their lead content is below 1%.

"Mechanical Properties of Molding Powders," H. Wiegand and H. Wallhaufer, KUNSTSTOFFE, 51, 1, 7 (Jan. 1961).

With increasing usage of molded components, their short-time and long-term behaviors are of great importance. Stress-strain behavior and fracture mechanism give guidance to the designer and user, as well as do mechanical properties and their effect on molding and maximum utilization.

"UV Absorbents as Synthetic Resin Stabilizers," H. Gysling and H. J. Heller, KUNSTSTOFFE, 51, 1, 13 (Jan. 1961).

Possibilities and limits of effective light stabilization of plastic materials are pointed out. Various types of commercial UV absorbers on the market today are classified and examples given of their application.

"The Gas Chromatographic Identification of High Polymers," J. Voigt, KUNSTSTOFFE, 51, 1, 18 (Jan. 1961).

A method of identifying synthetic resins and similar materials, based on the pyrolysis of small amounts followed by gas chromatographic separation of the gaseous end-product, is discussed.

"Relation of Characteristic Properties of Different PVC Insulating Compounds," G. Buhmann and K. Grill, KUNSTSTOFFE 51, 1, 21 (Jan. 1961).

The factors of greatest interest in PVC insulating compounds are the properties of the polymer, behavior during gelling, and the data on the plasticized compound. Important properties of the powder are related; gelation time can be predicted by determinations on the powder; compound properties are also interrelated and related to the K-value.

"Representation of Phenol-Formaldehyde Condensates of Known Constitution and Uniform Molecular Size," H. Kammerer and H. Lenz, KUNSTSTOFFE, 51, 1, 26 (Jan. 1961).

Uniform molecular condensates were prepared with methylene chains, and studied with infra-red spectroscopy.

"Experiences with Glass Fiber Filled Polyester Molding Compounds," P. B. White, R. S. Jackson, and A. Rost, KUNSTSTOFFE, 51, 1, 33 (Jan. 1961).

A summary by the authors of their experiences with the subject molding compounds.

"Comparative Tests of Polyester Resins Show Wide Variances in Corrosion Resistance," S. S. Feuer, PLASTICS WORLD, 18, 9, 20 (Sept. 1960).

Test results show that a resin such as bisphenol A differs from a conventional general-purpose polyester.

"Flake-Glass Laminates," A. M. Shibley and H. L. Comins, PLASTICS WORLD, 19, 2, 16 (Feb. 1961).

A review of future activity in the field.

"Shrinkage of Glass-Reinforced Polyesters," H. V. Boenig and Norman Walker, MODERN PLASTICS, 38, 6, 123 (Feb. 1961).

Causes of shrinkage are reviewed. Detrimental shrinkage phenomena are discussed in the light of currently-available information.

"Stability of Thermoset Plastics at High Temperatures," S. L. Madorsky and S. Straus, MODERN PLASTICS, 38, 6, 134 (Feb. 1961).

Test results are given on polyesters, epoxy, silicones, and phenolic plastics at 360, 500, 800, and 1,200° C.

"Plastics," R. B. Seymour, IND. ENG. CHEM., 52, 12, 1038 (Dec. 1960).

Review of the plastics industries growth and current status.

"The Measurement of Gas Permeabilities of Films and Laminates," A. C. Filson and W. A. Holmes-Walker, PLASTICS (LONDON), 26, 280, 117 (Feb. 1961).

Description of a technique providing high sensitivity and accuracy for evaluating gas permeability ratings of films.

"Finishes for 'E' Glass to Improve Resin-Glass Properties," K. J. Brookfield and D. Pickthall, PLASTICS (LONDON). 26, 280, 135 (Feb. 1961).

The various finishes for glass fibers to improve processing and properties of glass-reinforced plastics are considered.

"For Lowest Cost Fiberglass-Reinforced Plastics—Air Preforming with Matched Metal Dies," Morgan Martin, INDIAN PLASTICS REVIEW, pg. 11 (Sept. 1960).

How to design molded structures to take advantage of economies in large-rate production.

"Reinforced Plastics Pierce Heat Barrier," H. A. Perry, MATERIALS RES. STDS., 1, 2, 122 (Feb. 1961).

Versatile materials are shown to find wide use in nose cones and rocket-motor casings and nozzles, but offer serious problems in quality control and testing.

"Polystyrene," J. K. Neely, PROGRESSIVE PLASTICS, pg. 41 (Feb. 1961).

A short article on types of polystyrene, their fabrication, and their usages.

"Viscosity and Flow Characteristics of PVC Plastisols," I. Lossius, RUBBER & PLASTICS AGE, 42, 2, 183 (Feb. 1961).

Condensation of a paper presented at the Oslo Congress last May. Viscosity and flow are discussed, with emphasis on the roles played by plasticizers, extenders, and plastisol particle size.

"Radiation Chemistry and Polymer Technology—Part 2," S. H. Pinner, BRIT. PLASTICS, 34, 7, 76 (Feb. 1961).

The conclusion of a patent literature survey on radiation.

"Caution: Handle with Care," C. A. Harper, SPE J., 17, 3, 225 (March 1961).

A safety program is outlined for handling liquid thermosetting resins.

"Foamed Plastic Particles—Versatile New Materials," B. L. Raskin, SPE J., 17, 3, 249 (March 1961).

A description of the preparation and properties of foamed plastic particles.

"New Heat Resistant Phenolic Molding Materials," W. G. Colclough, J. Harding, and C. Y. Meyers, SPE J, 17, 3, 255 (March 1961).

A discussion of new phenolic materials and their applications.

"Casting to Close Tolerances with Unfilled Epoxy Resins," B. W. Nelson, E. J. Norrisey, and S. D. Marcey, SPE J., 17, 3, 257 (March 1961).

Detailed evaluation procedure used by one refrigerator manufacturer for testing high-impact polystyrene inner door panels is described.

"Chemically Cross-Linked Polyethylene," B. C. Carlson, SPE J., 17, 3, 265 (March 1961).

Processing methods are described for converting polyethylenes to thermosetting materials.

"Vulcanization and Elastomeric Properties of Ethylene Propylene Copolymers," G. Natti, G. Crespi, E. DiGuilio, B. Ballini, and M. Bruzzone, RUBBER & PLASTICS AGE, 42, 1, 53 (Jan. 1961).

A paper presented at the Second International Synthetic Rubber Symposium in London last October.

"The Mechanism of Post Cure of 'Viton' A Fluorocarbon Elastomer," J. F. Smith and G. T. Perkins, RUBBER & PLAS-

TENITE DEVELOPMENT LABORATORY DOINGS AND FINDINGS

The All-Purpose Formulation —Gone Forever

Once upon a time . . . long ago . . . polyethylene producers had the idea that they could successfully fill all market needs with a single grade of polyethylene. A sweet dream, but fleeting. The list of formulas now offered is as long as your arm and growing every day.

Early this year when Eastman entered the polypropylene market commercially, it was with no lingering illusions of simplifying the complex needs of the plastics industry. Our first official Tenite Polypropylene price list, issued January 16, 1961, lists 15 polypropylene formulations of different flow rate and impact strength. The list includes formulations stabilized against ultraviolet radiation and formulations stabilized against heat. There are also special formulations such as those offered for food packaging use, which comply with F&DA regulations.

If you have a polypropylene application that requires a specially tailored formulation, get in touch with the Tenite representative nearest you. He can probably help.

A Fine Point

People often ask us, "If you compare polypropylene formulations having the same flow rate, how can you say that some of them have better flow characteristics or better moldability than others?"

Simple. The flow rate of polypropylene is generally measured in a 230° C. cylinder using a plunger weighing 2.16 kilograms. Here is the rub. Polypropylene formulations that flow the same under these laboratory conditions may, and often do, flow differently from one another under actual molding conditions where temperatures and pressures differ from those of the lab apparatus.

(Note that we say "flow rate." We hesitate to use the term "melt index" for polypropylene since the ASTM Standards, Section D1238, clearly define this term as a measure of flow at 190° C. under a load of 2.16 kilograms—the conditions generally reserved for measuring the flow of polyethylene.)

To really learn how a polypropylene formulation will mold or extrude, we suggest you make a trial run. We think you will be impressed by the performance of Tenite Polypropylene.

Gating for Polypropylene

Being a polyolefin, polypropylene bears a certain similarity to polyethylene. Don't let this fool you, however, when it comes to gating. Polypropylene has a sharper freezing point, a significant fact. It explains, for instance, why molders sometimes find that gates of intermediate size tend to freeze shut.

On the other hand, if you use a gate sufficiently large, it obviously won't matter if some of the melt "lines out" on the land. And small gates stay open because of the frictional heat generated as the plastic is forced through them. Small gates of 20 to 30 mils, and large gates of 90 mils and over, generally work well.

Eastman's plastics engineers can offer technical advice and assistance on processing of polyethylene, polypropylene, and cellulosics, and stand ready to help a fabricator work out knotty production problems. Feel free to write us at EASTMAN CHEMICAL PRODUCTS, INC., *Plastics Division,* KINGSPORT, TENNESSEE.

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Our research laboratory finds that 15 grams of popcorn packed in a transparent plastic bag along with 1 gram of oil and ½ gram of seasoning can be popped in just 3½ minutes when subjected to the necessary heat.

Now, if you think popping corn is a bit far afield for Eastman's Plastics Division, you're right. But we thought it afforded a tasty demonstration of how packaging film extruded from Tenite Polyester can be used for quick, clean cooking. We've also baked some fairly tempting rolls in the film, not to mention boiling a toothsome vegetable or two.

The water vapor transmission rate is only 0.63 x 10^{-3} g cm/cm² hr mm Hg for this polyester film. It retains oil and grease and can be heat-sealed by means of an impulse sealer. If you're interested, the film is extruded commercially by Terafilm Corporation, Canal and Ludlow Sts., Stamford, Conn., under the trademark TERAFILM.

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TICS AGE, 42, 1, 59 (Jan. 1961).

Reactions of the cross-linked elastomer are explained.

"Toluene Diisocyanate 2,6-Isomer—Its Effect on Urethane Polymers," S. E. Berger, F. L. Cataldo, F. J. Dwyer, and Herman Stone, SPE J., 17, 2, 170 (Feb. 1961).

Urethane polymers based on 2,6-TDI are shown to have greater linearity than those based on 2,4-TDI, and ultimate polymer properties are affected by time of gelation.

"The Resistance of Colored Polyethylene to Irradiation," E. H. Cornish, PLASTICS (LONDON), 25, 278, 503 (Dec. 1960).

Test results show that difficulties experienced on irradiation are not due to fading of dyes.

"The Ageing of Plastics—Part 3," P. DuBois and J. Hennicker, PLASTICS (LONDON), 25, 278, 517 (Dec. 1960).

This third part of a four-part article discusses differences between natural and artificial ageing.

Equipment

"What Price Output," R. K. Senn, SPE J., 17, 3, 233 (March 1961).

Short column pointing out that economies may give high costs in extruder modifications.

"The Importance of Good Fundamental Mold Design," C. E. Ballentine, SPE J., 17, 3, 241 (March 1961).

A short contributed column emphasizing mold design fundamentals.

"Epoxy Troweling Compounds—New Application Techniques," T. S. Loeser, SPE J 17, 3, 241 (March 1961).

A description of the design and construction of a machine which mixes resin, hardener, and filler.

"Extrusion of Sheet from High Density Polyolefins," Robert Doyle, SPE J., 17, 2, 165 (Feb. 1961).

How to equip and run a sheet-extrusion operation.

"Plastisol Gelation—A New Instrument and Formulating Technique," W. H. Bauer, SPE J., 17, 2, 174 (Feb. 1961).

Discussion of a new instrument that simulates production conditions.

"24-Impression Tool for Screw Caps," H. Gastrow, KUNSTSTOFFE, 51, 1, 39 (Jan. 1961).

Brief discussion of a tool.

"Making Low-Cost Molds With an Epoxy-Aluminum Formulation," R. T. O'Connor, PLASTICS WORLD, 18, 9, 26 (Sept. 1960).

Brief article on these molds and their properties.

"Trends in Extruder Design," John Badonsky, MODERN PLASTICS, 38, 6, 114 (Feb. 1961).

A report on latest developments and how they contribute to optimum performance. Mentioned are cylinders, thrust units, speed reducers, variable-speed drives, heater systems, cooling systems, and other machine components.

"Efficient Plasticization Control," F. Seyffert, PLASTVERARBEITER, 11, 7, 329; 11, 8, 372; 11, 9, 404 (July, Aug., & Sept. 1960).

Different types of control devices and control systems are described in detail in this discussion of the technology of electrical heating and temperature control for processing plastics. (In German.)

"Equipment for Low Pressure Moulding," M. G. Burgess-Short, AUSTRALIAN PLASTICS, 16, 187, 29 (Feb. 1961).

Brief description of equipment available for low-pressure molding.

Applications

"Epoxy Varnishes. Effects of Maleinization," R. Montequi, A. Doadrico, and M. Corrisco, REVISTA PLASTICOS, 11, 66, 366 (Nov.-Dec. 1960).

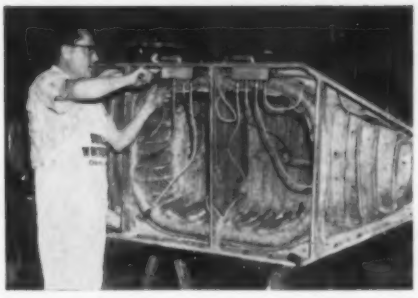
After a brief review of the production of epoxy resins and their use in varnishes, the authors discuss their experiments with varnishes containing varying proportions of linseed oil and Epicote 1004; also with linseed oil, Epictote 1004, and maleic anhydride. It was found that even when the proportion of Epicote is reduced by half, the addition of maleic anhydride improves quality; it shortens drying time considerably and improves hardness and resistance to cold water, heat, and acids; however, resistance to alkali is somewhat lower. (In Spanish.)

"Plastics in Agricultural Installations," G. Saccenti, MATERIE PLASTICHE, 26, 9, 829 (Sept. 1960).

This was a paper read at the VI National Building and Housing Congress held at Caglieri, June 21-26, 1960. The possibilities for plastics in conveying and distributing water, in installations for protecting and promoting growth of farm products, and in farm houses and farm buildings, are rapidly reviewed on the basis of examples in the United States, Europe and Japan. An extensive bibliography is added. (In Italian.)

"Rigid Glass-reinforced Laminates in the Electrotechnical Field," J. K. Hyde, POLIPLASTI, 8, 42, 48 (Sept.-Oct. 1960).

The author describes the pre-treatment of fiber glass for use in laminates for the electrical industry, and the methods of producing such laminates with phenolic, silicone, melamine, polyester, epoxy, and PTFE resins. Tables compare the properties of products made from American and British materials. (In Italian.)



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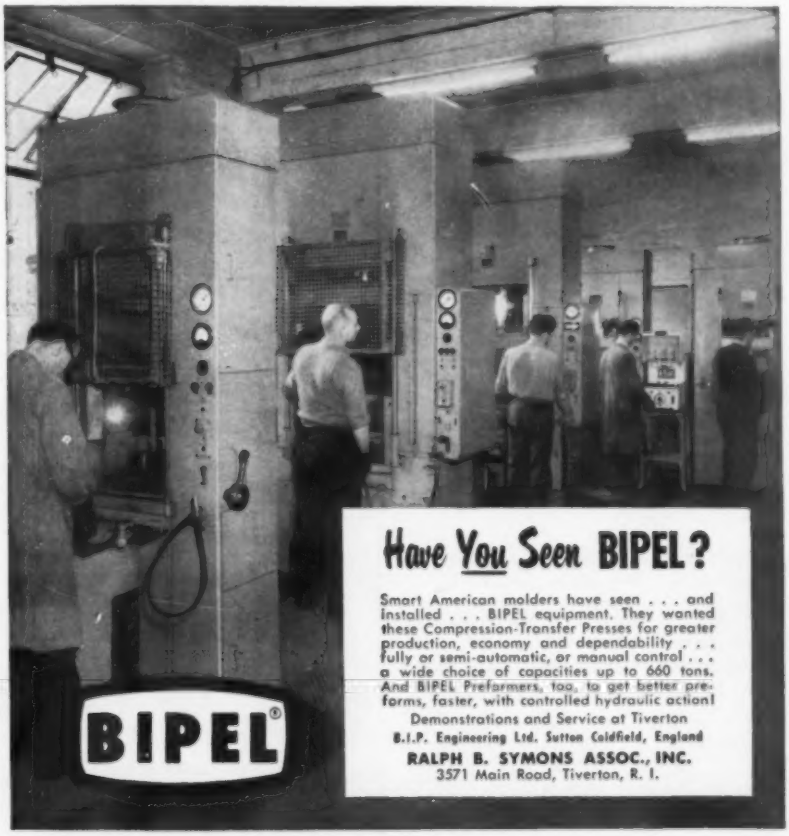

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"Plastics in Scandinavia," O. Ollila, BRIT. PLASTICS, 33, 11, 523 (NOV. 1960).

Brief review of developments in plastics in the past few years.

"Polythene Film for Mulching," H. R. Spice, PLASTICS (LONDON), 26, 281, 56 (March 1961).

Brief review of horticultural use of polythene film.

"New Plastics for Cars," Herman Mark, INDIAN PLASTICS, 11, pg. 10 (Nov. 1960).

Review of recent progress in the automotive field.

"The Economics of Plastics in Use—A Study of the Building Industry," R. G. L. Welham, PLASTICS (LONDON), 26, 280, 52 (Feb. 1961).

A study of costs in design, fabrication, installation, transportation, and erection.

"Plastics for Building," D. G. Keith, AUSTRALIAN PLASTICS, 16, 186, 13 (Jan. 1961).

Description of current trends.

"How to Use Laminates and Foams," George Brawner, AUSTRALIAN PLASTICS, 16, 186, 18 (Jan. 1961).

Description of uses in carpeting.

"Polyvinyl Chloride Film, Its Application in Bookbinding," Vivian Bird, PLASTICS IN AUSTRALIA, pg. 29 (Jan. 1961).

The product is described, together with its use by high-frequency welding as a binding material.

"Epoxy Resins in Flooring," P. A. Dunn, RUBBER & PLASTICS AGE, 42, 2, 200 (Feb. 1961).

A review of epoxy-based floors, their properties and applications.

"Polyester Resins for Coating Applications," T. L. Phillips, BRIT. PLASTICS, 34, 7, 69 (Feb. 1961).

Review of the chemical aspects of some developments which have contributed to successful surface coating usages.

"Applications of Glass Reinforced Polyesters to Large Structures," J. W. Heidacher, SPE J., 17, 3, 237 (March 1961).

A successful application in power plant service is described.

"Evaluation of High Impact Polystyrene for Refrigerator Door Liners," D. A. Davis, J. V. Schmitz, R. S. Hagan, and R. O. Carhart, SPE J., 17, 3, 260 (March 1961).

One company's approach to testing materials for qualification in appliance service.

"Recent Developments in Applications of Polyamide Resins," Z. Szirak, POLIPLASTI, 8, 42, 5 (Sept.-Oct. 1960).

Though their high price limits expansion, polyamide resins have made considerable advances in the technical field, and it is felt that their superior properties will enable them to compete successfully with certain traditional plastics. Various recent applications are discussed, developments in America and Italy are mentioned, and it is shown how and why price affects progress in the latter country. (In Italy.)

"Polymers as Additives in Mineral Oils," W. Bornengo, MATERIE PLASTICHE, 26, 11, 1039 (Nov. 1960).

The types of polymers used as additives to improve viscosity of oils and to lower their freezing point are polyisobutylene, polymethacrylate, and polystyrene. The properties and action of some preparations (chiefly American) are described. (In Italian.)

Requests for copies, reprints, or further information on any article abstracted in this department should be addressed to the publisher of the magazine where the article appeared. The publishers and their addresses are given below:

"Applied Plastics"
The Scientific Press, Ltd.
11 Gloucester Road
London, S.W. 7, England

"ASTM Bulletin"
American Society for Testing Materials
1916 Race St., Philadelphia 3, Pa.

"Australian Plastics"
Australian Trade Publications, Ltd.
243 Elizabeth Street, Suite 406,
Sydney, N.S.W., Australia

"British Plastics"
Iliffe & Sons, Ltd.
Dorset House, Stamford St.
London, S.E.I., England

"Canadian Plastics"
341 Church St., Toronto, Ont., Canada

"Chemical and Engineering News"
1155 Sixteenth St. N.W.
Washington 6, D.C.

"Gummi & Asbest"
A. W. Gentner-Verlag
Forsterstrasse 131, Postfach 688
Stuttgart, W. Germany

"Hule Mexicano y Plasticos"
Filomeno Mata 13-11, Mexico, D.F.

"Industrial and Engineering Chemistry"
1155 Sixteenth St. N.W.
Washington 6, D.C.

"Industries des Plastiques Modernes"
Les Publications Techniques Associees
40 Rue du Colisee, Paris 8e, France

"Jornal de Plasticos"
Av. Rio Branco, 211
Sao Paulo, Brazil

"Kunststoffe"
Carl Hanser Verlag
Leonard Eck Str. 7, Munich 27,
Germany

"Kunststoff-Rundschau"
Brunke Garrels, Verlagsbuchhandlung
Borgfelder Strasse 83, Hamburg 26,
Germany

"Kunststoff Zerater"
Kettenhofweg 111
Frankfurt A.M., Germany

"Materials in Design Engineering"
Reinhold Publishing Corp.
430 Park Ave., New York 22, N. Y.

"Materie Plastiche"
Via Farneti 8, Milan, Italy

"Matiéres Plastiques"
Galerie du Center, Bloc 3
Rue des Fripiers, Brussels, Belgium

"Mechanical Engineering"
American Society of Mechanical Engineers
29 W. 39th St., New York 18, N. Y.

"Modern Plastics"
575 Madison Ave., New York 22, N. Y.

"Oesterreichische Plastic-Rundschau"
Ployer & Co.
Aegidiengasse 5, Vienna 6, Austria

"Pensez Plastiques"
Les Editions De Berne et Ci 11,
Boulevard des Batignolles Paris 8e,
France

"Plaste und Kautschuk"
Veb Verlag Technik
12 Unter den Linden
Berlin N.W. 7, Germany

"Plastic"
Danish Technical Press
31 Vester Farimogsgade
Copenhagen 5, Denmark

"Plastica"
Kunststoffeninstituut T.N.O.
Julianalaan 134, Delft, The Netherlands

"Plastics"
Temple Press, Ltd.
Bowling Green Lane, London E.C.I.
England

"Plastics Age News"
Plastics Age Co., Ltd.
34 Higashi-Shimizu-machi
Minami-ku
Osaka, Japan

"Plastics Industry"
130 Clarendon St.
Boston 16, Mass.

"Plastics Industry News"
Institute of Polymer Industry, Inc.
Mitsubishi-Maka- 6-1
Marunouchi, Chiyoda-ku
Tokyo, Japan

"Plastics World"
Cleworth Publishing Co., Inc.
1 River Road, Cos Cob, Conn.

"Plastiques Informations"
94 Rue Saint-Lazare
Paris 9e, France

"Plastverarbeiter"
Rudolf Zechner Verlag, G.m.b.H.
Speyer/Rhein, Germany

"Poliplasti"
E.T.A.S., Via Andrea Mantegna 6,
Milan, Italy

"Practical Plastics"
Box 4850
G.P.O. Sydney, Australia

"Progressive Plastics"
481 University Avenue
Toronto 2, Canada

"Revista de Plasticos"
Inst. "Alonso Barba"
Serrano 119, Madrid, Spain

"Rubber and Plastics Age"
Rubber and Technical Press, Ltd.
Tenterden, Kent, England

"SPE Journal"
65 Prospect St., Stamford, Conn.

"Spectator"
Published by New England Chapter
Society of Plastics Engineers, Inc.
Somers, Conn.

"Transactions of the Plastics Institute"
6 Mandeville Place, London W.I.
England

"Western Plastics"
Western Business Publications
274 Brannan Street
San Francisco 7, Calif.

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CALENDAR of COMING EVENTS

May 16-18
Building Research Institute 1961 Spring Conferences, Shoreham Hotel, Washington, D. C.

May 22
ASME Design Engineering Conference and Show. Cobo Hall, Detroit, Mich.

June 5-9
SPI National Plastics Conference. Commodore Hotel, New York, N. Y.

June 5-9
SPI Ninth National Plastics Exposition. Coliseum, New York, N. Y.

June 11-15
ASME Summer Annual Meeting. Statler Hilton, Detroit, Mich.

June 14
SPE Quebec Section RETEC. Plastics in Packaging. Montreal, Quebec, Canada.

June 15-16
Purdue University, SPI, and American Society of Tool and Mfg. Engineers. Annual Plastics for Tooling Seminar. Purdue University, Lafayette, Ind.

June 16-25
Europlastic 61. International Plastics Exhibition. Palais des Floralies, Ghent, Belgium.

June 19-20
Plastics Institute. Education and Training in the Plastics Industry. Institution of Electrical Engineers, Savoy Place, London W.C. 2, England.

June 21-July 1
International Plastics Exhibition and Convention. Grand, National, & Empire Hall, Olympia, London.

June 25-30
ASTM Annual Meeting. Chalfonte-Haddon Hall Hotel, Atlantic City, N. J.

July 3-7
Gordon Research Conferences. Polymers. Colby Junior College, New London, N. H.

July 17-21
Gordon Research Conferences. Elastomers. Colby Junior College, New London, N. H.

July 27-August 1
International Symposium on Macromolecular Chemistry. Queen Elizabeth Hotel, Montreal, Quebec, Canada.

September 3-8
American Chemical Society National Meeting. Chicago, Ill.

September 12
SPE Central Indiana Section RETEC. Plastics for Tooling. Hotel Severin, Indianapolis, Ind.

October 5
SPE Buffalo Section RETEC. Plastics Foams. Niagara Falls, N. Y.

October 12-13
SPI New England Section Conference. Wentworth-by-the-Sea, Portsmouth, N. H.

October 17-19
Plastics Show of Canada. Automotive Building, Exhibition Park, Toronto, Canada.

October 25
SPE Kentuckiana Section RETEC. Plastics in Major Household Appliances. Louisville, Ky.

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Abstracts of Important Articles (Cont'd.)

"The Use of Plastics in Horticulture and Suggestions for Further Development," G. Vogel, PLASTE U. KAUTSCHUK, 7, 7, 325 (July 1960).

In East Germany, too, experiments are being conducted to increase output of garden products by the use of clear plastics film for green houses, protective covers for plants and for compost heaps, and similar purposes. Present developments and measures for solving still existing problems, are discussed. (In German.)

"Light-Weight Building Elements with Synthetic Resin Dispersions and Pre-Expanded Styropor Particles," K. Kohling and R. Petri, KUNSTSTOFFE, 50, 11, 648 (Nov. 1960).

The strength and thermal insulation properties of light-weight concrete containing Styropor P particles can be further increased by incorporating synthetic resin dispersions.

"Why Biaxially Oriented Pipe?" W. E. Gloor, MODERN PLASTICS, 38, 3, 111 (Nov. 1960).

The equipment to produce biaxially-oriented pipe and its applications are described.

"How Molding Conditions Affect Polypropylene," Howard Robb, MODERN PLASTICS, 38, 3, 116 (Nov. 1960).

Wide variations in machine conditions are shown to have little effect on properties of resultant moldings.

"Applications of Linear Polyethylene," R. G. Askew, INDIAN PLASTICS REVIEW, No. 7, 19 (July 1960).

A discussion of household, packaging, and industrial applications for Marlex polyethylene.

"Fighting Corrosion with Butyrate Pipe," W. P. Gideon and R. O. Hill, Jr., WESTERN PLASTICS, 7, 11, 25 (Nov. 1960).

A generalized review of applications for butyrate pipe.

"Epoxy Replaces Quartz in High-Vacuum 'Doughnut'," J. O. Turner, APPLIED PLASTICS, 3, 10, 22 (Oct. 1960).

Description of a laminated replacement in an annular vacuum tank.

Domestic Production and Sales of Plastics and Resin Material, Preliminary Total 1960 and January 1961

Following are the partly estimated and revised statistics for the domestic production and sale of plastics and resinous material during the months of 1960 and January, 1961. Units listed are in pounds, dry basis unless otherwise specified. Data on alkyds and rosin modifications have not been included since their use is primarily limited to the protective coating industry.

	Preliminary total, 1960		January, 1961	
	Production	Sales	Production	Sales
Cellulose Plastics:				
Cellulose acetate and mixed ester:				
Sheets, under 0.003 gage	18,561,725	18,845,797	1,237,764	1,269,281
Sheets, 0.003 gage and over	22,345,822	21,109,149	1,731,568	1,451,712
All other sheets, rods, and tubes (including other cellulose plastics)	9,300,084	10,130,501	764,683	746,279
Molding and extrusion materials (including other cellulose plastics)	91,216,822	88,753,844	6,652,054	5,794,788
Nitrocellulose sheets, rods, and tubes	1,148,468	1,363,988	88,515	93,434
TOTAL	142,572,921	140,203,279	10,474,584	9,355,494
Phenolic and Other Tar-Acid Resins:				
Molding materials	208,101,899	191,406,855	15,736,315	13,351,519
Bonding and adhesive resins for—				
Laminating (except plywood)	69,553,985	44,604,724	4,879,152	3,545,617
Coated and bonded abrasives	14,793,403	13,300,300	1,127,037	1,181,653
Friction materials (brake linings, clutch facings, and similar materials)	12,558,517	11,427,884	994,118	781,431
Thermal insulation (fiber glass, rock wool)	43,318,482	42,708,688	5,322,833	2,949,150
Plywood	54,448,222	44,173,104	4,889,036	4,081,074
All other bonding and adhesives uses	69,328,650	67,476,067	4,646,257	4,440,106
Protective-coating resins unmodified and modified except by rosin	25,532,405	20,682,696	1,665,289	1,282,527
Resins for all other uses	44,893,053	39,823,350	3,169,200	2,897,151
TOTAL	542,528,616	475,603,668	42,429,237	34,510,228
Urea and Melamine Resins:				
Textile-treating and textile-coating resins	30,808,731	28,833,446	2,488,833	2,298,455
Paper-treating and paper-coating resins	27,326,747	25,565,537	1,870,422	1,989,445
Bonding and adhesive resins for—				
Laminating	35,547,345	28,224,843	2,030,681	2,276,730
Plywood	93,198,148	90,058,261	5,596,802	5,398,195
All other bonding and adhesive uses	27,216,315	26,726,594	3,214,983	3,367,998
Protective-coating resins, straight and modified	37,016,217	26,592,624	2,580,735	1,891,721
Resins for all other uses, including molding	116,460,245	113,293,566	8,785,621	8,689,321
TOTAL	367,573,748	339,294,871	26,568,087	25,820,865
Styrene Resins:				
Molding and extrusion materials:				
Straight polystyrene	288,784,029	240,206,446	21,352,371	17,291,020
All other	376,884,472	310,719,404	30,159,508	29,018,085
Protective-coatings	71,022,169	64,821,910	6,542,528	5,655,165
Textile and paper treating and coating resins	70,378,882	54,592,199	4,835,851	4,732,103
All other uses	167,143,455	228,674,687	10,156,778	17,277,377
TOTAL	973,603,007	899,014,646	73,047,036	73,983,740
Vinyl and Vinyl Chloride Resins:				
Polyvinyl chloride and copolymer resins (50% or more PVC) for—				
Film (resin content)		98,698,235		7,310,648
Sheeting (resin content)		127,049,263		10,615,214
Molding and extrusion (resin content)		284,567,234		23,416,901
Textile and paper treating and coating (resin content)		62,559,002		5,149,518
Flooring (resin content)		161,105,804		12,866,225
Protective coating (resin content)		38,616,800		2,901,547
All other uses (resin content)		112,617,228		7,724,556
All other vinyl resins for—				
Adhesives (resin content)		59,063,195		4,501,434
Protective coatings (resin content)		27,286,885		2,082,338
All other uses (resin content)		124,730,996		9,869,655
TOTAL	1,167,102,002	1,096,294,642	87,690,532	86,438,036
Coumarone-Indene and Petroleum Polymer Resins	232,162,158	231,067,080	14,808,990	16,310,336
Polyester Resins:				
For reinforced plastics	132,303,000	115,187,684	8,019,843	8,588,672
For all other uses	24,566,783	22,702,508	1,579,443	1,380,602
TOTAL	156,869,783	137,890,192	9,599,286	9,969,274
Polyethylene Resins:				
For film and sheeting		386,836,400		40,559,500
Molding materials		168,205,808		14,319,676
Extrusion materials		155,631,742		14,376,506
For all other uses		485,240,743		38,358,107
TOTAL	1,336,055,689[1]	1,195,914,693[2]	114,481,696[3]	107,613,789[4]
Epoxy Resins:				
For protective coatings		21,205,932		1,883,615
For all other uses		30,778,493		2,302,366
TOTAL	62,741,740	51,984,425	4,775,295	4,185,981
Silicone Resins	5,119,918	4,615,169	434,391	443,358
Miscellaneous Synthetic Plastics and Resin Materials	295,540,637	253,396,195	26,308,208	23,649,403
GRAND TOTALS	5,281,870,219	4,825,278,860	410,617,342	399,280,504

[1] 15.7% produced by the low-pressure process.
[2] 13.9% produced by the low-pressure process.
[3] 16.9% produced by the low-pressure process.
[4] 13.2% produced by the low-pressure process.
SOURCE: United States Tariff Commission, Chemical Division.

Current Market Prices

This listing is as comprehensive and up-to-date as possible. The full listing will appear regularly, while intervening issues will carry a brief tabulation of price changes and additions.

Suppliers whose products do not appear are invited to submit their price data for inclusion in the published listing, as well as any price changes and additions promptly as they occur in order to assure maximum accuracy and value of the listing.

As can be seen, trade names or other company-originated names do not appear in the published tabulation. Products are grouped under their chemical names or chemical types. Any new products to be added to the list should also be so identified by the supplier firm. With the published listing, any questions on prices for specific products should be referred to us. We, in turn, can inform you of the suppliers whose product prices are included in our published listing and, similarly, refer these requests directly to the appropriate supplier(s).

Prices in general are f.o.b. works. Ranges indicates variations in grade, quality, quantities, and geograhical locations of customers. No guarantee of these prices is made, and spot prices should be obtained from the individual suppliers.

Adhesives

Chloroprene type	gal.	$1.50 /	$1.60
Epoxy type	lb.	1.33 /	2.00
Silicone type	lb.	1.64 /	10.80
Thiocyanate type	lb.	.1725/	.20

Catalysts

Ammonium thiocyanate	lb.	$0.1725/	$0.26
Peroxide, acetyl, 25% in DMP	lb.	1.75 /	4.00
Benzoyl, dry, 96%	lb.	.88 /	2.00
Wet, 50% paste in TCP	lb.	.89 /	2.25
In silicone fluid	lb.	2.75 /	4.25
In BBP	lb.	3.00 /	4.25
Caprylyl, liquid, 50% in mineral oil	lb.	4.45 /	5.00
In DOP	lb.	5.00	
Cyclohexanone, 45% paste in DBP	lb.	3.00 /	4.00
Powder, 85%, in DBP	lb.	2.00 /	3.00
p-Cyclobenzoyl, paste, 50%			
In mineral oil	lb.	4.25 /	5.00
In TCP	lb.	5.00	
2,4-Dichlorobenzoyl, 50%			
In silicone oil	lb.	4.25 /	5.00
40% in silicone oil	lb.	5.00	
Di-t-butyl	lb.	2.00 /	4.00
Other peroxides	lb.	2.05 /	5.00

Colorants

Black, std.	lb.	.90 /	4.10
Gel coats	lb.	.61 /	.86
Carbon black	lb.	.0575/	.87
Paste	lb.	.65 /	.74
Bone blacks	lb.	.175 /	.2775
Iron oxide	lb.	.15 /	.23
Lampblack	lb.	.1225/	.175
Masterbatch	lb.	.60 /	.63
Paste (for epoxies)	lb.	1.58 /	2.15
(for vinyls)	lb.	.50 /	.66
Paste dispersion	lb.	.85 /	1.90
Paste concentrate	lb.	.82 /	1.20
Pigment dispersion	lb.	.83 /	1.15
Colloidal dispersions	lb.	.66 /	1.45
Aqueous	lb.	.115 /	.395
Blue, std.	lb.	.90 /	2.75
Concentrate	lb.	.95 /	3.00
Masterbatch	lb.	.85 /	1.13
Pearl	lb.	1.38	
Metallic	lb.	.02	
Paste (for epoxies)	lb.	1.25 /	2.60
(for vinyls)	lb.	.62 /	1.84
Paste dispersion	lb.	.85 /	2.40
Paste concentrate	lb.	.78 /	.80
Phosporescent	lb.	.24	
Brown, std.	lb.	.87 /	4.00
Copper tinsel	lb.	.10	
Gel costs	lb.	.59 /	1.04
Iron oxide	lb.	.15 /	.24
Metallic bronze	lb.	.02	
Paste (for epoxies)	lb.	1.18 /	1.47
(for vinyls)	lb.	.48 /	1.67
Paste dispersions	lb.	.75 /	1.70
Paste concentrate	lb.	.65 /	2.30
Gold, metallic	lb.	.21	
Paste dispersions	lb.	1.40 /	1.60
Tinsels	lb.	.10	
Gray, gel coat	lb.	.59 /	.84
Paste (for epoxies)	lb.	1.40	
Paste dispersion	lb.	1.45 /	2.20
Green, std.	lb.	.90 /	3.25
Pearl	lb.	.10	
Concentrate	lb.	.95 /	3.00
Metallic	lb.	.21	
Phosphoresecent	lb.	.24	
Masterbatch	lb.	1.20 /	1.23
Paste (for epoxies)	lb.	2.86	
(for vinyls)	lb.	.80 /	1.83
Paste dispersions	lb.	.85 /	2.70
Paste concentrate	lb.	.80 /	2.15
Chromic oxide	lb.	.45 /	1.40
Orange, dry	lb.	$0.49 /	$3.50
Gel coat	lb.	.75 /	1.05
Lithopone	lb.	1.63 /	1.86
Paste (for epoxies)	lb.	1.58	
(for vinyls)	lb.	.74 /	4.27
Paste dispersion	lb.	.55 /	2.80
Paste concentrate	lb.	1.58	
Purple, pearl	lb.	.10	
Red, std.	lb.	.1425/	5.00
Cadium lithopone	lb.	1.90 /	2.86
Selenide	lb.	4.60 /	7.15
Concentrate	lb.	2.25 /	2.50
Iron oxide	lb.	.0475/	.205
Metallic	lb.	.021	
Masterbatch	lb.	.75 /	.88
Paste (for epoxies)	lb.	2.35 /	3.77
(for vinyls)	lb.	1.20 /	3.82
Paste dispersions	lb.	.90 /	3.05
Paste concentrate	lb.	5.42 /	6.49
Venetian	lb.	.065 /	.1325
Silver, metallic	lb.	.0165	
Paste (for epoxies)	lb.	1.55	
(for vinyls)	lb.	.89 /	.91
Paste dispersion	lb.	.85 /	1.45
Paste concentrate	lb.	1.02	
Tinsels	lb.	.10	
Yellow, std.	lb.	.12 /	3.50
Cadium lithopone	lb.	1.21 /	1.29
Gel coat	lb.	.61 /	1.03
Masterbatch	lb.	.90 /	.93
Concentrate	lb.	1.00 /	2.50
Iron oxide	lb.	.1225/	.1875
Paste (for epoxies)	lb.	2.15 /	2.55
(for vinyls)	lb.	.58 /	3.70
Paste dispersions	lb.	.90 /	2.20
Paste concentrate	lb.	.65 /	2.87
White, std.	lb.	.54 /	4.00
Concentrate	lb.	.70 /	1.25
Gel coat	lb.	.59 /	.84
Masterbatch	lb.	.75 /	.80
Paste (for epoxies)	lb.	1.02	
(for vinyls)	lb.	.48 /	.60
Pearl	lb.	.10	
Paste dispersion	lb.	.70 /	2.00
Paste concentrate	lb.	.705 /	.725

Fillers

Aluminum silicate pigments	ton	21.50 /	65.00
Barytes	ton	60.00 /	123.00
Paste concentrate	lb.	.705 /	.725
Calcium carbonate, ppt	ton	30.00 /	187.00
Std.	ton	15.00 /	35.00
China clay	ton	40.00	
Flours	ton	50.00 /	106.00
Flocks, cotton	lb.	.12 /	.30
Rayon	lb.	.50 /	1.25
Nylon	lb.	.35 /	2.75
Mica	lb.	.075 /	4.44
Silica	ton	25.00 /	48.50
Whiting	ton	8.75 /	13.25
Oster shell	lb.	30.00	
Wollastonite	ton	29.00 /	47.50

Miscellaneous

Anti-Fog	gal.	8.69 /	16.95
Anti-Static	gal.	3.57 /	8.50
(for films)	gal.	8.00 /	8.50
Purging cmpd. (for injection)	lb.	.40	
Wetting agent (for dry coloring)	gal.	2.50 /	3.20
(for wet operations)	lb.	2.59 /	3.69

Mold Release Agents

Silicone type: Cmpds	lb.	4.70 /	5.20
Emulsions	lb.	1.09 /	1.65
Fluids	lb.	2.74 /	6.00
Solvent emulsions	lb.	.40 /	4.95
Stearates: Barium	lb.	.41 /	.46
Calcium	lb.	.39 /	.44
Magnesium	lb.	.42 /	.47
Zinc	lb.	.41 /	.48

Plasticizers

Adipate, Butyl Cellosolve	lb.	$0.45 /	$0.47
Didecyl	lb.	.265 /	.375
Dibutoxyethyl	lb.	.425 /	.46
Diisodecyl	lb.	.40 /	.44
Diisobutyl	lb.	.41 /	.44
Dioctyl	lb.	.40 /	.535
Diisooctyl	lb.	.40 /	.435
2-ethyl hexyl	lb.	.40 /	.435
Isooctylisodecyl	lb.	.40 /	.435
Isooctyl	lb.	.49 /	.535
n-Octyl decyl	lb.	.40 /	.44
Azelate, dioctyl	lb.	.445 /	.49
Di-2-ethyl hexyl	lb.	.455	.505
Epoxy, polymeric	lb.	.3225/	.3525
Monomeric	lb.	.3475/	.3775
Ester, Fatty Acid	lb.	.3525/	.3775
Monomeric	lb.	.35 /	.60
Laurate, Butoxyethyl	lb.	.39 /	.40
Oleate, Butyl	lb.	.24 /	.42
Butoxyethyl	lb.	.30 /	.33
Methoxyethyl	lb.	.31 /	.34
Phosphate, Tributyl	lb.	.50 /	.535
Tricresyl	lb.	.325 /	.36
Phthalate, Butyl Cellosolve	lb.	.35 /	.385
Butyl octyl	lb.	.255 /	.30
Cyclohexyl	lb.	.265 /	.305
Isodecyl	lb.	.26 /	.30
Butoxyethyl	lb.	.365 /	.375
Dibutyl	lb.	.285 /	.43
Dicapryl	lb.	.265 /	.445
Dicyclohexyl	lb.	.48 /	.595
Didecyl	lb.	.27	
Diisodecyl	lb.	.265	.45
Diisooctyl	lb.	.26 /	.445
Dioctyl	lb.	.27 /	.305
Isooctyldecyl	lb.	.27 /	.45
Methoxyethyl	lb.	.355 /	.405
Polyester type	lb.	.385 /	.7125
Polymeric type	lb.	.39 /	.93
High-solvating	lb.	.37 /	.425
Ricinoleate type	lb.	.32 /	.35
Sebacate, Dibenzyl	lb.	.91 /	1.04
Dibutyl	lb.	.655 /	.745
Dioctyl	lb.	.5925/	.6825
Soy Bean oil, epoxized	lb.	.3235/	.4775
Stearate, Butyl	lb.	.2225/	.3825
Butoxyethyl	lb.	.31 /	.32
Epoxized octyl	lb.	.3475/	.5325
Methoxyethyl	lb.	.32 /	.35
Octyl epoxy	lb.	.3925/	.447
Tallate, Octyl epoxy	lb.	.3475/	4.025

Resins, Molding, Casting & Coating

ABS type	lb.	.44 /	.74
Acetal	lb.	.65 /	.93
Colors	lb.	.74 /	1.24
Acrylic	lb.	.46 /	1.08
Alkyd	lb.	.1325/	.137
Allyl (diallyl phthalate)	lb.	.95 /	2.50
Carbonate	lb.	1.30 /	2.25
Cellulosics:			
Cellulose acetate	lb.	.35 /	.68
Reprocessed	lb.	.25 /	.36
Cellulose acetate-butyrate	lb.	.40 /	.81
Reprocessed	lb.	.35 /	.45
Cellulose propionate	lb.	.40 /	.81
Ethyl cellulose	lb.	.67	
Reprocessed	lb.	.30	
Epoxy, liquid	lb.	.60 /	1.41
Solid	lb.	.51 /	1.31
Fluorocarbons	lb.	3.25 /	11.00
Furane	lb.	.75 /	1.00
Liquid	lb.	.32 /	.44
Melamine coating solns	lb.	.3275/	.4375
Phenolic	lb.	.207 /	1.12
Coating solns	lb.	.305 /	.3525
Polyamide	lb.	.62 /	1.26
Coatings	lb.	.61 /	1.51
Graphite-filled	lb.	1.40 /	1.83
Heat-stabilized	lb.	1.09 /	1.55
Molybdenum sulfide-filled	lb.	1.19 /	2.07
Polycarbonate	lb.	1.30 /	2.29
Polyester, powder	lb.	.26 /	2.20
Coating	lb.	.0975/	.1275
Glass-reinforced	lb.	.41 /	.80
Polyethylene, low-density	lb.	.2375/	.615
Medium-density	lb.	.2375/	.6425
High-density	lb.	.275 /	1.29
Polypropylene	lb.	.42 /	1.17
Reprocessed	lb.	.50	
Polystyrene	lb.	.18 /	1.34
Reprocessed	lb.	.15 /	.26
Polyurethane	lb.	1.30 /	7.50
Silicones, casting	lb.	7.50 /	11.40
Molding	lb.	2.40 /	3.55
Urea coating solns	lb.	.205 /	.27
Vinyl, dispersion grade	lb.	.24 /	.325
Copolymers	lb.	.2025/	.44
Molding	lb.	.185 /	.66
Nitrile rubber blend	lb.	.45 /	.53
Reprocessed	lb.	.19 /	.22
Vinyl-vinylidene copolymer	lb.	.185 /	.32
Vinylidene	lb.	.205 /	6.00
Latex	lb.	.45 /	.52

(Continued on page 130)

Current Market Prices

(Cont'd. from page 129)

Solvents

Ketones: Acetate	lb.	.08 /	.22
Methyl isoamyl	lb.	.175 /	.315
Esters: Ethyl acetate	lb.	.125 /	.2675
Isopropyl acetate	lb.	.115 /	.255
n-Butyl acetate	lb.	.145 /	.285
Alcohols: Isobutyl	lb.	.13 /	.27
n-Butyl	lb.	.155 /	.295

Stabilizers

Alkyd tin mercaptide, liquid	lb.	2.50 /	3.15
Barium-cadmium complex, liquid	lb.	.50 /	.585
Solid	lb.	.97 /	1.25
Barium-cadmium laurate	lb.	.87 /	.90
Myristate	lb.	.72 /	.75
Barium-cadmium-zinc complex	lb.	.54 /	.56
Barium-zinc, liquid	lb.	.58 /	.615
Powder	lb.	.375 /	.44
Complex	lb.	.47 /	.50
Cadmium-barium, powder	lb.	.68 /	.895
Chelating agent, liquid	lb.	.57 /	.84
Cadmium-containing	lb.	.84 /	.87
Zinc-containing	lb.	.62 /	.80
Organic complex, liquid	lb.	.57 /	.845
Strontium-zinc laurate	lb.	.72 /	.75
Zinc, liquid	lb.	.48 /	.52

Abstracts of Important Articles (Cont'd.)

"Some Aspects of Plastics Insulated Cable Industry," P. S. S. Modaliar, INDIAN PLASTICS REVIEW, No. 6, 10 (June 1960).

A brief review of equipment, cable problems, materials, molds, and marketing of insulated cable.

"Graph for Calculation Gear Wheels Made of Resin Impregnated Fabirc," W. Ploch, KUNSTSTOFFE, 50, 11, 645 (Nov. 1960).

Description of a graph which takes into account such things as efficiency, number of teeth in the gear, modulus and width of gear teeth, and number of revolutions. This type of graphic representation is shown to be suitable for any material values, gear teeth and speed factors, and is based on a modified Lewis formula.

General

"Plastics and the Common Market," G. Moretti, MATERIE PLASTICHE, 26, 9, 821 (Sept. 1960).

In 1959, the six countries of the European Common Market together produced 1,366,000 tons of plastics, exported 378,000 tons, and imported 270,000 tons. The author considers the present situation and prospects for the immediate future of each of the countries involved, and then deals with the aspects, both favorable and less favorable, of the Italian Plastics market within the orbit of the Common Market. (In Italian.)

"Plastics Analysis and Testing in the Periodicals during 1959," K. D. Ledwoch, KUNSTSTOFF RUNDSCHAU, 7, 11, 523 (Nov. 1960). Part I.

Review of new or improved methods, equipment, standards for testing plastics and synthetic resins, and the semi-manufactures and articles made from them, as described in selected international periodicals in 135 references. (In German.)

"Following the Progress of Operations in Plastics Molding by Means of a Time Recorder," R. Kainz, KUNSTSTOFF-FUNDSCHAU, 7, 11, 529 (Nov. 1960).

General description of the way time recorders combined with alarm systems operate, and the advantages their use offers in helping to determine causes of interruptions, the relation of planned to actual time required for operations, as well as productivity, thereby indicating areas requiring improvement. (In German.)

"Survey of Output in a Plastics Workshop," C. P. Prieto and C. C. Molinero, REVISTA PLASTICOS, 9, 65, 296 (Sept.-Oct. 1960).

This study of production of phenolic electrical parts in a shop of the plastics department of Marconi Espanola, S.A., aimed at raising output with the same personnel and no new investment in equipment, except where substantial annual profit would result. (In Spanish.)

"Standards for Plastic Pipe and Fittings," F. W. Reinhart, SPE J., 17, 2, 159 (Feb. 1961).

Survey of current standards and work in progress on new standards.

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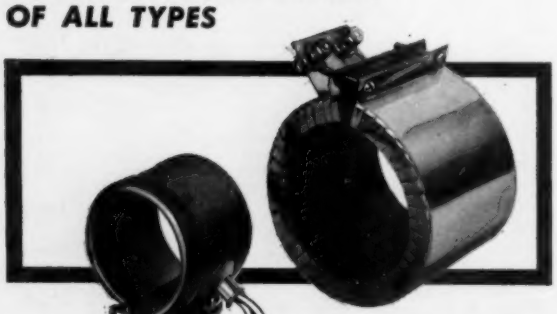

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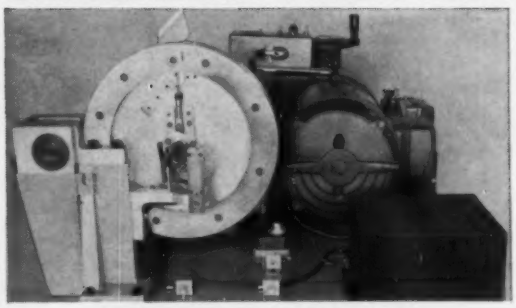

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